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Commercial Fisheries Abstracts

a monthly summary of important developments for the fishery industries

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Vol. 13 No. 6 June 1960

Fish and Wildlife Service
U.S. Department of the Interior
Washington D.C.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FRED A. SEATON, SECRETARY

FISH AND WILDLIFE SERVICE
ARNIE J. SUOMELA, COMMISSIONER

Commercial Fisheries Abstracts

DIVISION OF INDUSTRIAL RESEARCH AND SERVICES
BUREAU OF COMMERCIAL FISHERIES

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Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget November 23, 1956.

0.321 STUDIES ON THE MUSCLE PROTEINS OF THE SQUID

Matsumoto, Juichiro J.
Bulletin of the Tokai Regional Fisheries Research Laboratory No. 23, 51-63 (February 1960)

A study of the muscle protein of squid can be approached from two different points of view. The first is strictly in regard to the significance of the characteristics of squid muscle in the technology of squid meat, and the second is in regard to the acquisition of basic knowledge in regard to the biochemistry of muscle contraction. The muscle of the squid mantle is composed of smooth muscle fibers.

The organoleptic properties of squid muscle are entirely different from those of the muscles of meat or fish. Uncooked, fresh squid muscle is soft, fine, and elastic. Upon boiling, the squid muscle releases moisture and changes to an elastic mass that is tough in texture. The taste of squid is sweet as compared to the taste of other fish.

The histological structure of squid muscle is quite different from that of mammalian and fish muscles. Squid muscle is high in moisture (75 to 78 percent) and low in fat (0.6 percent) as compared with the composition of mammals and fishes. Squid has an equal amount of nitrogen but less protein in comparison with mammals and fish. The nonprotein nitrogen content of squid muscle is high. Among the nonprotein nitrogen compounds in squid are betaine, taurine, trimethylamine oxide, proline, histidine, arginine, alanine, and glycine. The presence of these compounds only explains the characteristic flavor of squid meat.

Because it seemed likely that the peculiarities of squid muscle depend upon the characteristics of the proteins that compose it, the author decided to study these characteristics by isolating and examining the proteins of squid.

(over)

 ABSTRACTER: Kathryn L. Osterhaug

0.36 ADENOSINETRIPHOSPHATASE IN RED AND WHITE MUSCLE

Tonzetich, Joseph and Kare, Morley R. (Cornell University, Ithaca, New York)
Archives of Biochemistry and Biophysics 86, 195-200 (February 1960)

Introduction.--Opinion as expressed in the literature is sharply divided at as to whether or not myosin and muscle adenosinetriphosphatase (ATPase) are identical substances. The present study was initiated to learn if any differences in ATPase characteristics can be detected between red and white muscle within a single species. In the past, investigations have not been concerned with a specific muscle as a source of the enzyme.

Experimental.--The quadriceps femoris, a typical pigmented muscle of fowl, was selected for study because of its anatomical homology with rat leg (red) muscle. The pectoral muscle of fowl was selected because it provides an excellent source of white muscle. ATPase from quadriceps femoris muscle and from pectoral muscle were compared in a series of experiments. Solubility, optimum pH, activation of the enzyme, and inhibition of the enzyme provided a basis for the comparison.

KCl extraction of ATPase.--Forty, healthy White Leghorn hens were used in this experiment. Tissue samples weighing approximately 1 g. were removed rapidly, weighed on a torsion balance, and immersed in 10 ml. of ice-cold extraction solution. This solution consisted of 0.1 M KCl, 0.01 M Na_2CO_3, 0.04 M $NaHCO_3$, and 0.001 M KCN. Except for minor changes necessary to facilitate the quantitative determinations, the extraction procedure used was that of Kielley and Meyerhof (1950).

Water extraction of ATPase.--Humphrey and Humphrey (1950) suggested that the KCl-soluble ATPase might also be water soluble. Therefore, an attempt was made to isolate active water-soluble preparations from both white and red muscle. The inactivation of the water extracts was retarded

(over)

 ABSTRACTER: Martin Heerdt

0.36 THE OCCURRENCE AND SIGNIFICANCE OF TRIMETHYLAMINE OXIDE IN MARINE ANIMALS

Groninger, Herman S. (U. S. Bureau of Commercial Fisheries, Seattle 2, Washington)
Special Scientific Report: Fisheries No. 333, 22 pp. (December 1959) (Bureau of Commercial Fisheries, Fish and Wildlife Service, U. S. Department of the Interior, Washington 25, D. C.)

Trimethylamine oxide has been reported in a coelenterate, an echinoderm, some molluscs, all crustaceans, all elasmobranchs, most teleosts, a reptile, and in mammals from a marine environment as well as in a crustacean, most teleosts, and an amphibian from a fresh-water environment. In general, animals from a marine environment contain much larger amounts of the oxide than do animals from a fresh-water environment. The oxide is unevenly distributed among marine animals. The factors of geographic environment, species, season, size, and location in the animal affect the content of oxide in marine teleosts.

Trimethylamine oxide has not been reported in plants; however, other tertiary amine oxides and tertiary amines have been reported.

Trimethylamine oxide appears to contribute to the osmotic pressure of the elasmobranch. It is not known if the oxide functions as an osmotic pressure agent in the teleost.

Certain marine animals possess a strong methylating capacity. It has been reported that trimethylamine oxide will methylate choline in a system isolated from a mammal; however, no such system has been isolated from a marine animal.

It has been suggested that trimethylamine oxide is endogenous in origin and that it might be a product of protein metabolism. There is, however, no direct evidence to prove this point. Mechanisms for the synthesis of trimethylamine oxides have not been demonstrated in animals or plants.

(over)

 ABSTRACTER: Herman S. Groninger

0.5 BACTERIA CONCERNED IN THE SPOILAGE OF HADDOCK: PRELIMINARY PAPER

Gee, A. H. (Fisheries Experimental Station, Halifax, Nova Scotia)
Contributions to Canadian Biology and Fisheries (New Series) 3, No. 14, 347-364 (1927)

This paper is divided into two parts. Part I deals with the effect of salts on the growth of bacteria concerned in the spoilage of fish muscle. Part II deals with the source and significance of a spore-forming rod.

In the study of the effect of commercial salts on growth, two salts were selected for comparison with chemically pure sodium chloride. Samples of commercial salt were taken from two sacks as supplied to the trade: one contained Malagash, a mined salt, and the other contained Turk's Island, a solar-evaporated salt.

Several sets of cultures were carried out with Malagash salt, the procedure being identical to that followed for chemically pure NaCl. Typical results are given in Series II and III for the chemically pure NaCl and in Series IV and V for the Malagash salt.

These data are presented in tables 1 and 2 (see over). A study of the tables shows that there was a stimulation of growth when 1.5 percent of either type of salt was added to the medium. Similar results were obtained with the Turk's Island salt; that is, a favorable influence was noted when 1.5 percent salt was added to the medium, whereas when 5 percent salt was added, the growth was about the same as or less than that in control cultures to which no salt had been added.

The author summarized his work as follows:

1. An anerobic, spore-forming organism has been isolated consistently from fresh and spoiled haddock muscle.
2. With this bacillus as a criterion, two commercial salts used by the fish industry have been shown to exert an effect on the growth of bacteria similar to the effect of pure sodium chloride.
3. The bacillus, because of its pronounced variability, may be more important in the breakdown of haddock muscle than previously has been thought.

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 ABSTRACTER: F. Bruce Sanford

MUSCLE PROTEIN OF SQUID

TRIMETHYLAMINE OXIDE IN MARINE ANIMALS

ATP IN RED AND WHITE MUSCLE

HADDOCK-SPOILING BACTERIA

0.36

In higher marine animals, the occurrence of trimethylamine oxide can be caused by an exogenous source, since it has been shown that the oxide can accumulate in the muscles of fish from trimethylamine oxide in the food. The zooplankton could obtain the oxide by converting exogenous trimethylamine to the oxide or by synthesizing the oxide from smaller fragments. The primary origin, however, of trimethylamine oxide in marine animals is still to be explained.

A bibliography of 66 references is included in the report.

0.5 (Cross Reference: 3.5)

Table 1.--Effect of commercially pure NaCl on growth of bacillus

Series II			Series III		
% NaCl added to medium	Colonies on plate	Cells per cc.	% NaCl added to medium	Colonies on plate	Cells per cc.
0.0	82	4.6×10^8	0.0	4	0.2×10^8
1.0	156	8.8×10^8	1.0	61	3.4×10^8
2.0	236	13.3×10^8	1.5	104	5.8×10^8
3.0	133	7.5×10^8	2.0	91	5.1×10^8
4.0	82	4.6×10^8	2.5	66	3.7×10^8
5.0	71	4.0×10^8	3.0	44	2.5×10^8

Table 2.--Effect of Malagash salt on growth of bacillus

Series IV			Series V		
% Salt added	Colonies on plate	Cells per cc.	% Salt added	Colonies on plate	Cells per cc.
0.0	200	0.72×10^8	0.0	296	0.84×10^8
1.0	1122	4.04×10^8	0.5	916	2.86×10^8
2.0	608	2.19×10^8	1.0	1433	4.48×10^8
	none	.....	1.5	too thick to count	?
			2.0	1388	4.34×10^8
			2.5	990	3.09×10^8
			3.0	542	1.69×10^8

0.321 (Cross Reference: 1.89)

Properties of squid muscle protein.--Although squid muscle is similar to fish muscle in protein composition, the properties of the actomyosin-like fibrous protein differ considerably from the properties of rabbit or carp actomyosins. The actomyosin-like protein of the squid shows adenosine-triphosphate response of viscosity and streaming birefringence as well as superprecipitation. Because of these characteristics it is likely that the actomyosin-like protein of squid is related to the contractile function of this muscle. The author proposes to refer to the actomyosin-like protein of squid as M-actomyosin.

0.36

by the addition of KCN.

Dialysis of KCl-soluble ATPase preparations.--Five-ml. aliquots of the KCl-soluble ATPase preparations were dialyzed for 6 hours at 0° to 5° C. against 40 volumes of a solution that consisted of 0.05 M glycine, 0.1 M KCl, and 0.001 M KCN at pH 7.0.

Determination of ATPase activity.--Twenty-four-hour-old preparations of ATPase were assayed. The reaction mixtures contained: 1.0 ml. of M histidine buffer (pH 6.9), 0.1 ml. of 0.1 M $MgCl_2 \cdot 6H_2O$, 0.2 ml. of enzyme preparation, and 0.5 ml. of ATP solution (150 μg. acid-labile phosphorus) at pH 7.4. The test systems, the control mixture without enzyme, and the reference blank containing no added ATP each were incubated for 5 minutes at 38° C. and then centrifuged. The supernatants were analyzed for inorganic phosphorus within 2 hours after centrifugation.

Results.--ATPase preparations obtained from the two muscle sources were differentiated on the basis of their solubility. An active ATPase was extracted with water from the red muscle but not from the white muscle. Active preparations from both muscle sources were soluble in dilute KCl. The KCl extracts of the water-soluble white-muscle sediment yielded ATPase activity comparable to the ATPase activity of direct KCl extracts.

Magnesium was the most effective activator of all active ATPase preparations. Manganese activated the enzyme from both muscle sources but proved to be only 50 percent as effective as Mg. The ability of calcium was limited to a modest activation of white-muscle ATPase only. At a constant concentration of Mg, Ca inhibits ATPase to the same degree that an equivalent amount of Mg activates ATPase. In systems where both Mg and Mn are present, the expected influence of Mn took precedence over that of Mg.

Dialysis of the enzyme preparations failed to remove any factor necessary for ATPase activity, and residual activity remained unchanged after dialysis.

1.0112 OCEANOGRAPHY AND THE HAWAIIAN SKIPJACK FISHERY

Seckel, Gunter H. and Waldron, Kenneth D. (U. S. Bureau of Commercial Fisheries, Honolulu, Hawaii)
Pacific Fisherman 58, 11-13 (February 1960)

The annual skipjack catches from Hawaiian waters since 1948 have varied between 6 million pounds in 1957 and 14 million pounds in 1954. The monthly landings vary with the season, from less than 100,000 pounds during the winter to more than 2,500,000 pounds during the summer.

Although small skipjack are present in island waters throughout the year, the success of the summer season depends upon the availability of the 20- to 30-pound fish.

The skipjack fishery is conducted within an area that seldom extends more than 100 miles from land. Because the fishing fleet does not range over a wide area, the fluctuations in landings are credited with reflecting the availability of skipjack in Hawaiian waters.

The variations in skipjack landings are a source of hardship both to the fishermen and to the processor. It is important, therefore, to investigate the causes and to try to predict the fluctuations in advance of the fishing season. To assist in this investigation, an oceanographic study was started.

The Hawaiian Islands are located in the vicinity of a boundary that separates two types of water. To the north and west is the western North Pacific type, with a salinity of more than 35 parts per thousand (3.5 percent). To the south and east is the transition type of the California Current Extension with a salinity of approximately 34.7 parts per thousand (3.47 percent). This boundary is located just south of the islands during the winter and begins to work northward early in the year. It passes through the islands in April or May and brings with it the lower salinity water of the California

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 ABSTRACTER: Kathryn L. Osterhaug

1.0145 U. S. S. R.

Anonymous
Pacific Fisherman 58, 155-156 (January 25, 1960) (Annual Yearbook)

The Union of Soviet Socialist Republic (U.S.S.R.) is aiming the expansion of its fisheries at tuna, an attractive resource as yet virtually untouched by Soviet fishermen, for export as well as for domestic production.

In 1959, A. V. Mikheev, a member of the Fisheries Division of the U.S.S.R. State Planning Authority, declared that in order to create the broad range of fishery products called for by the present U.S.S.R. 7-year plan, commercial exploitation of such species as tuna, sardines, and saury must be developed as soon as possible. Sardine fishing by Soviet vessels in the tropical Atlantic and saury fishing in the Pacific already are on a commercial basis. To attain an annual tuna catch of 22 million pounds by 1965, which is called for in the 7-year plan, the U.S.S.R. plans to build a number of specialized tuna boats to be based in the Far East for year-round tuna fishing in the Pacific and a larger number of combination tuna-boat trawlers to be based in Baltic and Black Sea ports for seasonal tuna fishing in the tropical Atlantic.

Mikheev recommends that the U.S.S.R. fishing industry first concentrate on development of long-lining and seining, techniques in which Soviet fishermen are experienced. Large-scale programs of exploratory and experimental fishing have been established. In 1959, at least one Soviet vessel was long-lining tuna in the western Pacific as a part of the tuna-fishery development program.

Far Eastern operations are reported to have fallen short of expectations in recent years because of the Japanese high-seas fishing for salmon. In 1959, the U.S.S.R. sent a large fleet of factoryships

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 ABSTRACTER: June H. Olden

1.0156 IRAN

Anonymous
Pacific Fisherman 58, 159-160 (January 25, 1960) (Annual Yearbook)

Consumers in the United States and elsewhere are showing an increasing interest in shrimp. Accordingly, nations with underdeveloped shrimp resources are finding these resources to be economic assets that can be converted into international credits with a relatively small investment and a minimum of risk. Iran, for example, is now developing its shrimp resources. In only a few months, Iran attained a rank of 11th place among nations in the amount of shrimp shipped to the United States.

Important expansion of the Iranian shrimp operations began late in May 1959, after adequate refrigeration facilities had been provided and suitable vessels to supply the freezers had been imported. The expansion includes addition to the Iranian company's fleet of (a) seven 65-foot trawlers equipped with diesel engines and having a displacement of 50 tons and (b) one mothership, 1000 tons gross registry, equipped for freezing and processing.

The shrimp-fishing company in Iran had hoped to operate the year around, but the United States fishermen operating the boats are convinced that the season lasts only from October through April.

By October, the joint Iranian-United States shrimp-fishing company had 10 shrimp vessels operating in the Abbas area, and the catch was reported to be large. The shrimp were frozen, packed, and shipped to the United States on board one of the larger vessels at Bandar Abbas.

A joint Japanese-Iranian company was set up in about 1955, but the Japanese withdrew their boats 2½ years later. Since then, the company has continued operations on a limited basis.

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 ABSTRACTER: June H. Olden

2.01 STUDIES OF FISH SPOILAGE II. THE ORIGIN OF TRIMETHYLAMINE PRODUCED DURING THE SPOILAGE OF COD MUSCLE PRESS JUICE

Beatty, S. A. (Atlantic Fisheries Experimental Station)
Journal of the Fisheries Research Board of Canada 4, No. 2, 63-68 (May-July 1938)

Beatty and Gibbons (1936) used the amount of volatile base as a measure of fish spoilage. Four groups of volatile bases are possible: (1) ammonia, (2) primary amines, (3) secondary amines, and (4) tertiary amines. By the use of formaldehyde, ammonia and primary amines were excluded. Since the volatile base from spoiling fish did not react with nitrous acid, it was not a secondary amine but, rather, a tertiary amine. The volatile base tertiary amine was converted to the oxide, and the melting point and mixed melting point were found to correspond with those of trimethylamine oxide. Table 1 (see over) gives the data on the volatile base developed in cod-muscle press juice.

Changes in trimethylamine and trimethylamine oxide were studied in cod-muscle press juice at 21°, 10°, and 0.5°C. In each case, the following were determined: the trimethylamine nitrogen and the sum of trimethylamine nitrogen and trimethylamine oxide nitrogen. If the trimethylamine formed during the spoilage of fish-muscle press juice is entirely from the trimethylamine oxide, the sum of the nitrogen from trimethylamine and trimethylamine oxide should be constant. It was found, however, that this total nitrogen increased by a maximum of 6 percent in the cod-muscle press juice allowed to spoil at 10° and at 0.5°C. It was concluded that at least 94 percent of the trimethylamine was derived from the reduction of trimethylamine oxide.

See table, over.

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 ABSTRACTER: David T. Miyauchi

1.0145

and trawlers into the eastern Bering Sea, where they fished international waters off the coast of Alaska for at least 8 months. Although these operations probably could not compensate for the decline of the salmon resource, it is believed that the tonnage produced was very large.

The great strides made by the Soviet fisheries have been due largely to the development of a productive, modern fishing fleet. Trawlers, seiners, and factoryships of large capacity have been built. Recent 5-year plans have stressed expansion and mechanization of the fleet, and such modern features as stern-trawling equipment, freezers, and echo sounders have been introduced. Success of Soviet high-seas fishing is partly attributable to the widespread use of exploratory vessels and aircraft.

Expansion of Soviet activities in the tropical tuna fisheries is forecast. The Japanese have reported the presence of at least one Soviet fishing vessel apparently long-lining for tuna in the waters to the east of New Zealand, and Soviet missions to Japan have shown marked interest in the tuna industry there. It is presumed that the Soviet tuna fishery primarily would be designed to supply the domestic market because the areas in which the Soviet Union sells most of its export fishery products are not now considered to be well-developed markets for canned tuna.

2.01 (Cross Reference: 7.81)

Table 1.--The development of secondary and tertiary amines in cod muscle press juice at various temperatures

Storage temperature	Storage period	Secondary and tertiary amine nitrogen per 100 ml. press juice		
		Secondary and tertiary	Tertiary	Secondary
		mg.	mg.	mg.
0.5° C.	15 days	109	108	1
10° C.	2 days	55	54	1
	4 days	107	106	1
21° C.	17 hours	27.6	27.3	0.3
	41 hours	99	102	- -

1.0112 (Cross Reference: 1.125)

Current Extension. This process is reversed in August and the boundary again passes the islands in October or November and brings back the high salinity waters of the western North Pacific.

The spring movement of the boundary appears to be associated with the success of the Hawaiian skipjack fishery. Whenever California Current Extension-water bathes the islands during the summer, as is indicated by salinities of less than 35 parts per thousand, the annual skipjack landings have been average or better than average in volume. Whenever the salinities were greater than 35 parts per thousand, the annual landings were less than average in volume.

These ideas about the association between fishing success and oceanography in the Hawaiian Islands, as obtained from salinity measurements, also are supported by temperature studies. Early and rapid warming of the water near the Island of Oahu, as the boundary begins to move northward, appears to be associated with a well-developed California Current System. Of particular interest to the fishing industry is the early warming of the water prior to the fishing season and the fact that this can be monitored by measuring the temperature of the surface water.

The results of the authors' investigations indicate that both the seasonal and the annual variations in the occurrence of skipjack within the island region are associated with environmental changes. They do not know as yet, however, which of the environmental factors directly influence skipjack movements. The lack of information inserts an element of uncertainty into any predictions that can be made at this time.

1.0156

Iran also has a valuable fishery resource in the sturgeon of the Caspian Sea, along with the caviar derived from their roe. In recent years, the frozen sturgeon from Iran has displaced to a considerable degree domestic Columbia River sturgeon on the New York market for smoking. An American firm won a 3-year contract for supplies of Caspian sturgeon and caviar in 1956 and again in 1959. The 1959 contract calls for (a) 40 metric tons of caviar to be delivered the first year; 50 tons, the second; and 60 tons, the third and (b) 250 metric tons of sturgeon to be taken annually.

The Soviet contract, signed in July 1959, is for 1 year only and calls for 46 tons of caviar and 600 tons of sturgeon.

1.0162 SOUTH WEST AFRICA

Keun, I. J. (Head of the Fisheries Section, South West Africa Administration)
Pacific Fisherman (Annual Yearbook) 58, 157-158 (January 25, 1960)

Growth of the fishing industry in South-West Africa has been phenomenal in recent years, the value of products increasing from about £ 400,000 in 1948 to nearly £ 10,000,000 in 1958.

The rock lobster industry is located at Luderitz, and the pilchard and maasbanker industry is concentrated at Walvis Bay, which is also the headquarters of the fresh-, frozen-, salted-, and dried-fish trades. At Luderitz, six modern, highly mechanized, licensed factories process rock lobsters as canned fish, frozen tails, and fish meal. Walvis Bay also has six modern, mechanized, licensed establishments. Two additional establishments handle only fresh, salted, and frozen fish, and one handles dried fish such as shark.

The emphasis of the rock lobster industry has shifted from canned lobster to frozen tails. Consumer demand, which actually exceeds supply, has been built up in the United States, France, and the United Kingdom, and the field of marketing is steadily broadening. Satisfactory methods of packing, handling, and distributing products have been evolved, and stability in processing and marketing has been achieved. Specific research is carried out from time to time as circumstances dictate.

The economy of the pilchard-maasbanker industry is buoyant mainly because raw material is readily available and there is a consistent demand for the products. The industry is established on sound, progressive lines and enjoys stable fishing conditions.

In recent years, there has been a significant trend toward increased output of canned fish. It has been thought advisable, however, to limit this output in order to avoid overproduction. Sales of

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 ABSTRACTER: June H. Olden

1.953 SHORE-BASED WHALING CATCH SHOWS BIG INCREASE OVER PAST SEVEN YEARS

Anonymous
World Fishing 9, 26-29 (February 1960)

Nearly 30 percent of the whales taken each year are caught by personnel from land-based whaling stations. During 1958, out of a total world catch of 64,586 whales, 24,690 were captured by whalers who were operating from stations outside the Antarctic and a further 3,406 whales were captured by whalers from three land stations in South Georgia. These whales amounted to 43 percent of the year's total.

The following table shows how the catch outside the Antarctic has been increasing since 1952. Totals are given in thousands of whales. Sperm whales account for virtually the whole of this increase. In contrast, the trend in the Antarctic has shown a steady increase in fin whales. The reason for the increasing interest in sperm whales undoubtedly is influenced by the fact that the price of sperm oil shows an upward trend. Sperm oil is inedible but has a number of industrial uses, including the manufacture of soap. Ambergris, which sometimes is found in the intestine of the sperm whale, may provide an extra incentive.

Year	Baleen whales	Sperm whales	Total
1952	8.5	6.1	14.6
1953	7.1	7.2	14.3
1954	8.1	10.7	18.8
1955	7.6	9.8	17.4
1956	7.9	11.6	19.5
1957	8.2	14.7	22.9
1958	9.4	15.3	24.7

The shore-whaling stations cover most of the oceans of the world. The shore station operated

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 ABSTRACTER: Kathryn L. Osterhaug

2.01 KEEPING QUALITY OF PACIFIC COAST DOGFISH

Moyer, R. H.; Southcott, B. A.; Baker, E. G.; and Tarr, H. L. A. (Fisheries Research Board of Canada, Technological Station, Vancouver, B. C.)
Journal of the Fisheries Research Board of Canada 16, 791-794 (December 1959)

Introduction. -- The available literature describes a spoilage pattern supposedly typical of elasmobranch fishes in which the muscle urea is hydrolyzed by bacterial urease to produce from 400 to 600 mg. of ammonia per 100 g. of fish flesh. Indeed, under some conditions, ammonia appears to be formed in concentrations sufficient to cause the muscle to assume an alkaline reaction, which in turn, occasions cessation of bacterial growth and an accompanying trimethylamine oxide reduction (Elliott, 1951; Simidu and Oisi 1951, 1952). The present investigation was made to determine the length of time that Pacific Coast dogfish could be stored under what usually are considered ideal conditions without undergoing serious bacterial spoilage.

Experimental. -- Sixty live dogfish were beheaded, eviscerated, thoroughly washed with running tap water, divided into four groups, and held under the following conditions: (a) in crushed ice; (b) in crushed ice after a previous dip in a 50 p.p.m. chlortetracycline solution; (c) in refrigerated sea water; and (d) in refrigerated sea water containing 10 p.p.m. of chlortetracycline.

The iced dogfish were held in galvanized tanks contained in an insulated box and were kept completely surrounded by an excess of crushed ice throughout the course of the experiment. The sea water was maintained at -1°C. in tanks as described by Baker, Southcott, and Tarr (1958). At intervals, fillets were cut from a single dogfish from each of the four treatments, skinned, packaged, and used for bacteriological and chemical determinations. One fillet was homogenized for the volatile base determinations, whereas the other fillet was incubated 18 hours at 10°C. Muscle pH was determined with a Beckmann Model G pH meter, using calomel and glass electrodes. Total volatile base nitrogen and trimethylamine nitrogen were determined immediately after sampling.

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 ABSTRACTER: Martin Heerdt

2.01 STUDIES OF FISH SPOILAGE VIII. VOLATILE ACID OF COD MUSCLE PRESS JUICE

Collins, V. K. (Atlantic Fisheries Experimental Station)
Journal of the Fisheries Research Board of Canada 5, No. 3, 197-202 (July 1941)

Acetic acid was identified as the only volatile acid produced in spoiling cod-muscle press juice; no unsaturated volatile acids were found.

The relationship of lactic acid breakdown to acetic acid production, both in the absence and in the presence of air, was studied. In both cases, the acetic acid production is greater than the lactic acid breakdown. During the first day or two the lactic acid content actually increases, sometimes very markedly, but after that time the acetic acid production is almost equivalent to the decomposition of lactic acid. Since the increase in acetic acid is more than equivalent to the decrease in lactic acid, it is concluded that the following reactions go on concurrently: unknown precursor → lactic acid → acetic acid.

Watson (1939) postulated the reaction: lactic acid + trimethylamine oxide → acetic acid + carbon dioxide + trimethylamine. With cod-muscle press juice in the absence of air, the production of carbon dioxide parallels the production of acetic acid more closely than it does the decomposition of lactic acid. This fact supports the reaction in equation 1.

The determination of acetic acid is too slow to be used as a routine method for evaluating spoilage; it could be used, however, to verify other methods. Its concentration starts at a relatively low and constant level and increases as spoilage progresses. With fish having a comparatively large percentage of trimethylamine oxide, it has no advantage over the trimethylamine test, but with fish

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 ABSTRACTER: David T. Miyauchi

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by the Union Whaling Company at Durban, South Africa has one of the highest annual productions of all the shore-based stations. Unlike the control of pelagic expeditions to the Antarctic, there is no general quota for shore whaling. The only restrictions imposed are in regard to fishing time--8 months for sperm whale and 6 months for baleen whales.

The operations of the Durban station extend to a distance of 100 miles from the coast. Airplane spotting is used to locate whales. During the last few years, production has shown a steady increase; 1,229 whales were taken in 1956 as compared with 1,626 in 1958. In order to improve their catcher efficiency, the Union Whaling Company is planning to install an echo whale-finder, the first shore-whaling company to do so.

The echo whale-finder has been used in pelagic expeditions for several years. It makes use of the Asdic principle to assist the gunner in tracking the whale and closing in to within firing range with a minimum of delay.

South Georgia once was a prolific whaling ground and the focus of Antarctic catching. The whales now appear to give the island a wide berth. Although it now is rare to see a "blow" from the shore, enough whales still are found within the striking distance of a modern catcher to keep three whaling stations open.

No survey of sperm whaling would be complete without mentioning the Azores whaling. To this day, sperm whales are caught off these islands in virtually the same way they were 100 years ago. From vantage points ashore lookouts scan the horizon for the telltale "blow." As soon as it is seen, the long boats are manned and towed by powerful motor boats to the vicinity of the blow. From the moment that the boat is slipped until the whale has been caught, the whole operation follows the same pattern as that with which Melville and his contemporaries were familiar.

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canned fish are negotiated by individual manufacturers, but the marketing of meal and oil is done in conjunction with South African producers, which ensures rational distribution, along with financial benefits.

With the limitation on availability of raw fish, improvement in technology has become exceedingly important in utilization of the fish. Research conducted by the Fishing Industry Research Institute in directions suggested by the industry ensures an objective and concerted approach to the improvement of techniques and the solution of problems. A fully equipped research laboratory is operated both at Luderitz and at Walvis Bay, and four modern ships are engaged in biological research at sea.

Advisory committees consisting of factory managers at Luderitz and Walvis Bay provide liaison between the industry and the government.

2.01 (Cross Reference: 7.82)

having a low percentage of trimethylamine oxide, it may give more reliable results.

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Results.--The results show considerable scatter, which is typical of what is found when fish of about the same post-mortem age are stored in ice or refrigerated sea water and individual fish are removed at intervals. Viable bacterial counts, particularly with the iced, untreated dogfish, began to increase sharply after about 14 days. The chlortetracycline treatment delayed bacterial growth noticeably with the iced dogfish but had no appreciable effect upon those held in refrigerated sea water. The total volatile base content of the muscle, which was initially about 10 mg. per 100 g., remained at about this level throughout the first 11 or 12 days of the experiment. Even after 3 weeks, the total volatile base content had not increased very markedly in most instances. The trimethylamine content remained low throughout the experiment, and only four fish had values in excess of 5 mg. per 100 g. after 13 days of storage. Organoleptic examinations indicated that the flesh of dogfish from all treatments became soft after about 2 weeks of storage. Dogfish that were not treated with chlortetracycline developed a stale odor after about 16 days and were putrid after 19 days. Those treated with chlortetracycline developed a stale odor after about 19 days. After 21 days, all dogfish were definitely unacceptable; however, those treated with chlortetracycline were sour rather than putrid. No definite ammoniacal odor was detected in any of the dogfish throughout the 21-day storage period.

The findings indicate that dogfish, when stored under nearly ideal conditions, appear to spoil no more rapidly than do most other sea fish. In contrast to results found by many other workers, very high concentrations of ammonia have not been found even after 21 days of storage. The reason for this is not known, but it may be attributable to the absence of a dominant population of urease-forming bacteria or in an inability of such organisms to develop at 0° or -1° C.

2.01 HANDLING, CHILLING AND FREEZING FISH PART 1. HANDLING AND CHILLING

Castell, C. H.; Harrison, J. S. M.; and Young, O. C.
Canadian Fisherman 47, 19-25 (February 1960)

During the period that fish are being stored and processed at the plant, two changes can cause the finished product to be rejected by the Canadian Government Specifications Board: (1) There can be a decrease in the quality of the fish and (2) the bacterial count on the fillets may increase beyond the limits allowed in the specifications.

The loss of quality usually means that the round fish have been held too long or at too high a temperature before being cut, or the fillets may have been mistreated or improperly chilled after being processed. The problem of bacterial count is chiefly a matter of plant sanitation and care in handling the fillets.

Loss of quality.--Loss of quality in the plant is seldom a problem. When spoilage does occur, it usually happens during warm summer weather, and most of the spoilage is confined to the storage period before the fish are cut. Bilge-like odors may develop in fish that are stored in direct contact with dirty wood surfaces or slimy concrete floors. At relatively high temperatures, this bilgy condition can develop in a few hours. Similar unpleasant off-odors can develop if pockets of fish juice and slime form near the bottom of tightly packed and improperly drained bins or boxes of fish. A layer of ice between the fish and the floor of the container prevents the development of these odors.

Fish become sour and develop other off-odors when they are held too long without ice, or when insufficient ice is used to properly chill them. To prevent the in-plant spoilage of whole fish: (1) reduce storage periods to a minimum, (2) keep the fish well iced, (3) use clean, well-drained bins

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 ABSTRACTER: Kathryn L. Osterhaug

2.1471 SAUSAGE FISHING

Hilton, John
Canadian Fisherman 46, 15 (December 1959)

Skipper W. F. Peck of the trawler Northern Sea tied up at Grimsby the other day after a voyage to the distant waters, and ended an experiment which may revolutionize fishing developments in the British industry.

He had taken part in the successful transfer of fish from one trawler to another in the open seas off Bear Island. The owning company has been exploring the possibilities of transfers for some time and has considered many suggestions. They decided that the best system was for fish to be floated off in special nets.

Shaped like huge sausages, the nets were braided with a mesh smaller than fishing net mesh. One end was tied up, like a trawl's cod end, and the sausage was dropped down the fish room hatch and the other end secured open. Gutted fish were dropped into the open end and when filled, the sausage held about a ton of fish. It was tied up at the top and lowered over the trawler's side, secured to a buoy. Several sausages were strung together by lines.

As soon as the sausages went over the side of the Grimsby trawler Northern Wave, a radio message was sent to the Northern Sea, then about 3 miles away. The sausages were only in the sea about 20 minutes before being sighted and within an hour the Northern Sea had the fish stowed away, and was on the way home.

New possibilities examined.--The experiment opens up several possibilities. Trawlers owned by the same company could fish an area while another vessel acted merely as a carrier. Trawlers

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 Reprinted in whole

2.12 NEW LIFE FOR LAKE ERIE

Ronayne, Mark
Trade News 12, 3-7 (January 1960)

Experimental fishing operations performed on Lake Erie in 1959 by the Canadian Department of Fisheries in cooperation with the Fisheries Research Board of Canada and the Ontario Department of Lands and Forests demonstrated that the midwater trawl can catch smelt in inland waters.

The background for the midwater trawl experiments on Lake Erie is a population explosion of the smelt, a species that was unknown in Lake Erie just over a decade ago. In the 1920's and 1930's the most desirable species of fish were considered to be a group of salmonoid fishes, primarily the whitefish, ciscoes, and lake trout.

Today swarms of smelt throng into the shallow waters during the spring spawning run. Members of the fishing industry along Lake Erie's shores have been marketing smelt for several years. Smelt production is a case of either feast or famine. Normally, the smelt are harvested in the springtime when they concentrate to spawn. Catching them at that time is a simple and highly productive process. In fact, much more fish can be harvested than the plants can possibly handle. The period of abundance is short-lived at best, however, for the supply dries up when the fish again disperse throughout the lake.

The aim of the midwater trawl experiments was to find a method of catching smelt in the open lake over the entire year so that production can be spread out, with a continuing flow of raw material to the plants and of products to the growing markets.

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 ABSTRACTER: Kathryn L. Osterhaug

3.231 TREATMENT AND USE OF ALBACORE CAUGHT OFF FRENCH WESTERN AFRICA COASTS

Crepey, J. R.
Rev. Gen. Froid., Fr. 35, 849-855 (Sept. 1958)
Bulletin de L'Institut International du Froid 39, 1524, 1526 (1959) (Paris)

Tuna fish, including the albacore caught off the African Coasts, contributes substantially to the canning industry (40 percent in 1956) of Africa. Tuna also is frozen either on shore, at the refrigerating plant at Dakar, or on board two freezing boats. The boats used are ordinary tuna boats, wooden or steel tuna trawlers, Basque tuna-sardine boats, baby clippers and tuna clippers. Only the two latter types of vessel are suitable.

The condition of the fish examined after they were unloaded showed the superiority of boats equipped with a refrigerated hold (the temperature of the fish is +1° C. after 2 days in ice compared to +4° C. with boats equipped with standard holds). The largest possible amount of ice must be loaded in order to combat the high temperature of the water; however, the temperature of the fish must not decrease below -1° C. The transport to the cold store (30 to 60 minutes) does not markedly increase the core temperature.

The refrigerated plant at Dakar can chill 200 tons of fresh fish at a time and in addition has a locker room of 120 m^2 held at +2° C. with a freezing capacity in tunnels of 40 tons per day at -35° C. The rooms held at -19° C. can hold 1,000 tons of fish. One of the freezer boats has 14 tanks of 25 m^3 with brine circulation; the other one, freezing in brine too, can freeze 15 to 20 tons per day.

Freezing in the cold store is satisfactory (a core temperature of -5° C. is obtained within 6 hours).

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 ABSTRACTER: Kathryn L. Osterhaug

2.12 (Cross Reference: 1.01112)

The experiments on Lake Erie were conducted with a trawl of the type developed as the result of work on the West Coast of Canada. Its construction consisted of: wings and front body section, 6-inch mesh spaced 1½ inches apart; main body section, 4½-inch mesh joined mesh to mesh to the 6-inch mesh; rear body section, 3-inch mesh joined mesh to mesh to the 4½-inch mesh; cod end, 1-inch mesh joined two to one to the 3-inch mesh.

Reviewing the fishing results, the gear specialists said that the smelt definitely appeared to be more plentiful in the Port Dover area than in the western section of the lake. Heavier concentrations were found in the deeper water that is typical of the western section of Lake Erie.

Smelt were predominant in the catch, accounting for about 97 percent of the overall results. Apart from coarse fish, small quantities of yellow perch, white bass, and yellow pickerel also were taken.

A side effect of the midwater trawl experiments was the interest generated among Lake Erie fishermen in new methods of fishing. In addition to midwater trawling, the high seas method of otter trawling has taken the fancy of several Canadian fishermen and has promoted the first stern-chute trawler in the entire Canadian fishing fleet.

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On board the first freezer boat, a temperature not lower than -8° C. was obtained after 48 hours, which indicated that the load was too large.

Very marked differences were observed between quick and slow freezing both in the frozen and the thawed fish; the differences were reduced after canning. Poorly frozen fish has a loose, or even fibrous texture.

The importance of evisceration was then studied. There does not seem to be any significant difference between round tuna and tuna that have been headed on board or ashore, except that albacore eviscerated on board and well bled have less red flesh. If albacore is to be kept only 14 days in the hold and if it is well iced, it is not absolutely necessary to eviscerate it; rapid and suitable icing is much more important. Noticeable differences were observed between canned products processed at Dakar and in metropolitan France. Those canned in Dakar have better appearance and have kept some flavor.

Thawing raises a difficult problem: the fish must be thawed almost at the moment of slicing and sterilization must be done as quickly as possible. Eighteen hours at +18° C. is required for the temperature of a 20-kilogram albacore to increase from -17° to -1° C.

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or boxes, and (4) chill to 32° F. or lower.

It also is possible for deterioration to take place in the fillets between the time they are cut until they are packed. This may occur during lengthy work stoppages when fillets are left either in the flumes or on the conveyor belts or cutting boards. These fillets may develop off-odors, and the exposed fillets are likely to deteriorate in texture and become soft. After the fillets are packaged, it is necessary to chill or freeze them as soon as possible.

High bacterial counts. -- The first essential for keeping bacterial counts down is a knowledge of the fundamentals of plant sanitation. In order to experience the maximum advantage from the use of modern equipment, the foreman must know where the bacteria come from, how they get on the cutting line, where they multiply, and how they can be eliminated.

The fundamental principles underlying the problem of bacterial contamination of fillets are as follows: Fish of top quality contain only a small number of bacteria in the flesh when the gutted fish reach the cutting table. A large number of bacteria are usually contained in the surface slime, in the gills, and in the gut cavity of the fish. Most of the bacteria present on the fillets at the time they are ready for packaging are from the surfaces of the gutted fish, or from the work surfaces that the fish contact as they pass along the processing line.

There is a considerable difference between the problem of the initial cleaning of a cutting line and that of keeping it clean throughout the day's operation. It is not enough to clean up once or twice a day if the line is going to be immediately recontaminated by a continuous procession of unwashed, slimy, bacteria-laden fish.

Methods of reducing bacteria on fillets include: (1) initial washing of round or gutted fish, (2) proper handling to prevent the transfer of bacteria from the skin of the fillet to the freshly cut surface, (3) the proper use of brines and preservative solutions, (4) sanitary practices in regard to the use of candling tables, and (5) the intelligent use of in-plant chlorination.

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just starting fishing could transfer their first few hauls to another ship about to leave for home, as with the Northern Sea, and this method would enable ships to stay at sea several days longer without deterioration in catches.

It could also point the way to trawlers fishing in packs and delivering their catch to a mother-ship which could quick-freeze the fish. At the same time the mother-ship could refuel the trawlers with oil and ice when they decided to fill up their own holds and go home.

The topping up catches of trawlers about to return home is the most immediately feasible idea and it may lead to owners forming an association among themselves to allow transfers to be made between all ships of one particular port.

Skipper Peck, commenting on the scheme when he arrived home, said, "We arranged everything over the radio the previous night and I was about 3 miles away from the Northern Wave when the sausages were released. We had no difficulty in sighting or hoisting aboard. The weather was good, but I can see no great difficulty in carrying out a transfer in winter. It may be a little more difficult but I think it can be done all right."

The transferred fish was landed only 6 days after being caught and was in good condition. Buyers noted how clean it was, probably because it had had a second washing in the sea during the transfer.

Samples have been sent to the research laboratories at Hull for expert examination.

3.230 SOME EXPERIMENTS ON THE FREEZING AND THAWING OF LIVE FISH

Martin, W. H. (University of Toronto)
Contributions to Canadian Biology (Supplement to the 47th Annual Report of the Department of Marine and Fisheries, Fisheries Branch), Sessional Paper No. 39b, 73-75 (1915)

Experimental. -- The species Fundulus heteroclitus (the common mummichog) was used. A large carbide tin covered with felt served as a refrigerator in which a mixture of ice and salt was held in an inner tin vessel. The fish were placed in an inner jar in water or in air, as required. Six experiments were performed.

In experiment 1, fish were put into a jar of sea water at 6° C., and the jar was lowered into the freezing mixture.

In experiment 2, fish were taken from a tank at 12° C. and put into water at -3.5° C.

In experiment 3, fish were put into water at +1° C., which was then lowered to -1° C.

In experiment 4, fish were taken from water at 2° C. and put into a dry jar at -15½° C.

In experiment 5, fish were put in water at -4° C. and left for 5 minutes. A number of the fish were then put into warm water, and the remaining fish were cut into cross sections.

In experiment 6, fish were packed in lumps of ice in a dish in which the water could drain off, and the dish was put into a refrigerator at 3° C.

Results. -- 1. The fish did not survive for any length of time at a temperature of -1° C. or lower.

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 ABSTRACTER: F. Bruce Sanford

3.231 FLOOR AND WALL DAMAGE IN ON-GRADE FREEZERS FROM FROST BUILDUP MAY BE PREVENTED OR CURED IN SEVERAL WAYS

Anonymous
National Provisioner 142, 36, 38, 62 (February 6, 1960)

Frost heavage must be considered if a freezer is to be built at grade or slightly below grade. This can be a problem with any freezer larger than 20 feet by 20 feet. Frost heavage is caused by the extraction of heat by the freezer from the soil at a rate faster than the heat can be replaced. The process is accelerated at lower temperatures, especially in the blast-freezer range of -20° F. or lower.

Signs that indicate frost buildup under the floor include the sticking or warping of cooler doors, and cracks in the floor with fingerlike extensions to the walls. When the ground under the floor is frozen the walls and floor will buckle. Through the years the grade soil will continue to lose heat to the freezer until the ground becomes frozen in the shape of a huge cone, working from the center toward the walls.

Frost heavage can be prevented by compensating for the lost heat. In freezers that are 20 feet by 20 feet or less in size, normal heat transfer from the adjacent ground and building will provide enough warmth to balance that lost. There are several protective steps that can be taken with freezers larger than 20 feet by 20 feet. For instance, the ground under the freezer can be ventilated by a system of air ducts. These ducts are practical and easy to install while the freezer is under construction. The ventilating system can be constructed either of concrete tunnels or of terra-cotta sewer tile. Either type of vent should be laid across the short dimension of the floor to allow maximum circulation of air. The ends of the pipes or tunnels should be screened to prevent the entry of rubbish.

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 ABSTRACTER: Kathryn L. Osterhaug

3.234 HANDLING, CHILLING AND FREEZING FISH
PART 2. FREEZING FISH

Castell, C. H.; Harrison, J. S. M.; and Young, O. C.
Canadian Fisherman 47, 19-25 (February 1960)

The temperature of fish affects not only bacterial growth but is also important from the standpoint of chemical deterioration. Time as well as temperature is a factor in both bacterial and chemical deterioration.

Cooling problems may appear to be quite simple, but when we try to determine theoretically the time required by a body to reach a given temperature under rather simple conditions, we encounter complicated mathematics. Some problems completely defy mathematical treatment.

Heat is transferred by radiation, conduction, and convection. Conduction is perhaps the most important in the handling of fish and this is governed by Fourier's Law:

$$q = KA \frac{t_1 - t_2}{L}$$

This means that a quantity of heat q is transferred through a slab of area A and thickness L with a thermal conductivity of K and temperatures of t_1 and t_2 existing at its two surfaces. This means that we can cool or heat more rapidly by increasing the surface area, reducing the thickness, and employing the greatest possible temperature difference.

The freezing of fish involves converting the fluid portion of fish muscle from a liquid phase to a solid phase, which entails merely the extraction of heat. The rate, at which the heat is extracted has an important bearing on the properties of the frozen product. Small ice crystals are formed when the fish is frozen rapidly, whereas if the heat is extracted slowly the crystals are correspondingly larger.

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 ABSTRACTER: Kathryn L. Osterhaug

3.238 ELECTRONIC COOKING

Anonymous
Seafood Merchandising 20, 15 (February 1960)

The relationship between electronic cooking and foil packaging is being studied by one of the large manufacturers of aluminum in the United States. They are convinced that the age of electronic cooking is approaching rapidly and that this method of cooking will have a profound effect upon the packaging of food products, particularly frozen foods. Electronic cooking will extend the features of ease and speed of preparation that already are features of frozen foods.

Aluminum foil already is accepted as a packaging material for frozen foods. Aluminum presents a barrier to electronic impulses and is a highly efficient conductor of heat. Cooking by electronic methods can be controlled with precision by taking advantage of these properties, according to a spokesman for the company.

The aluminum company is working on prototype frozen food packages that are especially designed for use in electronic ovens. One type of package under development is a combination rigid foil and plastic package to be used for complete family dinners. A smooth-wall, rigid foil container is filled with family-size portions of meat, potatoes, and vegetables. The top is of aluminum with a die-cut window covered with transparent or opaque plastic.

The cooking rate of the contents of the package is controlled by the shape of the die-cut window. The aluminum shields the food from the electronic impulses, whereas the thermo plastic material allows the electronic impulses to pass through. The window opening or openings can be designed to concentrate or limit the heat in each section of the container as needed.

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 ABSTRACTER: Kathryn L. Osterhaug

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Factors that must be considered when designing a subfloor ventilating system include soil composition, drainage, climatic conditions, and floor dimensions.

What can be done when incipient frost heavage is detected? Sometimes a trench is built around the perimeter of a building and steam-, hot water-, or warm oil-pipes are installed at the bottoms of outside footings. The induced heat will penetrate to the foundation walls and footings and thaw the ground.

If the floor must be replaced and ventilating methods cannot be installed, a grid of wrought-iron pipe may be laid on a crushed-stone foundation and warm water or fuel oil circulated through the pipes. After the connections have been welded and tested, a concrete subfloor is poured over the grid system. This serves as a foundation both for insulation and for the freezer floor.

Another alternative for combating frost heavage is the installation of an electrical, ground-heating system.

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2. The lower the temperature, the shorter was the time of survival.

3. At 0° and without water, the fish survived for 24 hours and were in good condition at the end of that time.

4. On being frozen stiff in air, the fish recovered if the exposure was not excessive.

5. Even when the fish were stiff, the viscera were not frozen; also there did not appear to be any freezing of the blood or flesh only a stiffening.

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For instance, meat could receive the highest transmission, vegetables less transmission, and items that require no direct cooking could be warmed by conduction from the neighboring high-heat items.

Theoretically, laminated foil cartons and pouches could also be constructed with plastic windows to serve in the same manner.

When the volume of demand warrants mass production of special containers for electronic cooking, the cost per unit should be only slightly higher than the cost of presently used foil containers.

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Controlled taste-panel tests that are carried out both with rapidly and slowly frozen samples of fish muscle have shown very slight differences in the taste reactions when the samples were consumed almost at once. When the storage factor was introduced, however, it was found that the rapidly frozen samples retained high quality for longer periods than did the slowly frozen samples.

Many attempts have been made to determine a critical rate of freezing for fish, but so far none has been defined. Many prolonged storage tests have indicated that if the thickest portion of a sample of fish is reduced from +5° F. to -5° F. in less than 2 hours, these samples will retain a satisfactory quality level for 6 months to a year.

The discussion dealing with heat transfer showed the effect of increased thickness of samples on the rate of change of fish temperature. The relationship was related to the square of the thickness providing the other conditions are kept constant. This means that if one sample is twice as thick as another sample it will take two or four times as long to freeze the thicker sample. This illustrates the difficulty encountered in freezing whole fish, particularly large thick ones.

Air is a relatively poor conductor of heat. It must therefore be kept moving rather rapidly in order to provide a satisfactory surface conductance factor. Freezing fish in air usually is done with an air-blast type of freezer.

In contact or plate-type freezers, air is eliminated as a heat carrier and, because of their relatively high effectiveness, they are recommended for freezing packaged fish. Contact freezers are not adaptable for freezing whole fish, therefore, air-blast freezers will probably remain until all commodities are frozen in packaged form.

3.64 THE EFFECT OF DRYING AND STORAGE IN THE DRIED STATE ON SOME PROPERTIES OF THE PROTEINS OF FOOD

Connell, J. J. (Torry Research Station, Aberdeen, Scotland)
Fundamental Aspects of the Dehydration of Foodstuffs, pp. 167-177 (1958) (London, England)

Proteins of food are not only of importance for their nutritive value, they also are important for the physical characteristics they impart to many foods. Organized into predominantly fibrous forms, the protein of meat and fish muscle comprise the main structural components. This structure is very different from the nonfibrous proteinaceous tissues of liver and kidney. Proteins are responsible for such important properties as capacity to gel, coagulate, thicken, emulsify, and foam of foods such as eggs, milk, and gelatin. Alterations in protein are often responsible for the impairment of these desirable qualities. The problem of retaining acceptable quality in proteinaceous foods is largely a problem of ensuring the stability of the particular protein involved.

Food-drying processes are capable of impairing the quality of food by their effects on proteins. Drying usually involves the application of heat, and proteins are among the most heat-labile of substances. The difficulties involved in the drying of proteinaceous foods have stimulated research to develop improved methods of processing. Spray-drying is now the method of choice in the production of high-quality dried egg- and dried milk-products. Warm-air tunnel drying has been used for drying minced precooked meat and fish but this method is not feasible for whole pieces of flesh. For the latter, vacuum processes including freeze-drying are being explored.

In order to understand the changes suffered by proteins during drying and storage and their relationships to alterations in the properties of food, it is necessary to understand the relationship between the structure of the proteins and the gross properties they confer on the foodstuff. An approach to this understanding can be made by considering certain basic, known features of protein structure in relation to the properties of food.

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 ABSTRACTER: Kathryn L. Osterhaug

4.11 ANALYSIS OF FATS AND OILS BY GAS-LIQUID CHROMATOGRAPHY AND BY ULTRAVIOLET SPECTROPHOTOMETRY

Herb, S. F.; Magidman, Paul; and Riemenschneider, R. W. (Eastern Regional Research Laboratory, Philadelphia, Pennsylvania)
Journal of the American Oil Chemists' Society 37, 127-129 (March 1960)

Purpose.--The present study was made to obtain more complete information on the quantitative aspects of gas-liquid chromatography as a practical analytical technique for determining fatty acid composition of natural fats and oils. Chromatographic analyses of known mixtures of pure fatty acid esters and of a series of fats and oils were compared with known values and with analyses by an alkali-isomerization ultraviolet spectrophotometric method.

Apparatus.--Conventional gas-liquid chromatography equipment was employed. The air bath was heated electrically, controlled to ±0.5° C. by a thermoregulator, and was uniform in temperature to within ±1° C. It housed a detector and coiled stainless-steel columns. A four-filament thermal conductivity cell, and a 2-mv., 11-inch strip chart recorder requiring 2 seconds for full-scale pen deflection were employed. Means for attenuating the detector signal to the recorder were provided. The chart speed was 30 inches per hour. The sample injection site was heated and controlled independently up to 350° C. Samples for analysis were introduced by microsyringe through a silicone rubber disc into the heated injection site. Provision also was made to heat the exit tube from the detector to avoid condensation. The emerging components could be collected by means of a cold trap.

Column packing and operation.--Two coiled stainless-steel columns, 8 feet long by $\frac{1}{4}$-inch outside diameter, with different packing and operating conditions were employed. Column I was packed with 6.6 g. of succinate polyester of diethylene glycol applied on 20 g. of 42 to 60 mesh Chromosorb. Column I was operated at 235° C. and 30 pounds per square inch gage of helium at a flow rate of 75 ml.

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 ABSTRACTER: Martin Heerdt

4.11 THE UNSATURATED FATTY ACIDS IN MENHADEN BODY OIL: THE C_{18}, C_{20}, AND C_{22} SERIES

Stoffel, W. and Ahrens, E. H., Jr. (The Rockefeller Institute, New York 21, New York)
Journal of Lipid Research 1, 139-146 (January 1960)

Introduction.--The present report marks the completion of a study intended to isolate and completely define the chemical structure of the unsaturated fatty acids of menhaden body oil. A previous report by Stoffel and Ahrens (1959) described the C_{16} acids; the present report describes the C_{18}, C_{20}, and C_{22} acids. The authors were able to account for more than 95 percent of all of the unsaturated acids in menhaden oil by the use of total quantitative gas-liquid chromatographic analysis. Only C_{14} monoene, traces of odd-numbered acids, and traces of three C_{22} acids remain uncharacterized. In this study, the authors determined the chromatographic characteristics of the acids that had been isolated in pure form. The retention characteristics and stability of the acids on polar and nonpolar gas-liquid chromatographic columns already have been described by Stoffel, Insull, and Ahrens (1958) and Farquhar et al. (1959).

Experimental.--The starting material was prepared from fresh menhaden and was not contaminated with head, liver, or visceral fats. Ahrens et al. (1959) already have given a complete description of this preparation as well as of a variety of the chemical characteristics of the oil. Low-temperature crystallization of the free fatty acids yielded the most highly unsaturated acids. The acids were then methylated and separated into C_{18}, C_{20}, and C_{22} chain-length groups by repeated fractional distillation. The investigators used only those fatty acid fractions that were homogeneous in respect to chain length as verified by gas-liquid chromatography after a small sample of each had been completely hydrogenated. The unsaturated esters of each chain length were then separated into groups varying in their number of double bonds by the use of a rubber-packed column for separation of the

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 ABSTRACTER: Martin Heerdt

4.64 EFFECT OF ADDITION OF ANTIOXIDANTS TO FROZEN GROUND BEEF

Caldwell, H. Mariel; Glidden, Mina A.; Kelley, George G.; and Mangel, Margaret (University of Missouri, Columbia)
Food Research 25, 139-144 (January-February 1960)

Introduction.--In recent years antioxidants have been used to help protect foods from the off colors, flavors, and odors associated with oxidative rancidity. Several workers have found that antioxidants used in combination sometimes have a more pronounced protective effect than when used singly. Of the many antioxidants tested, ascorbic acid and its sodium salt have been found to be the most useful in preserving the color of fresh meat. Both compounds have also been found to aid the regeneration of the red color in frozen meat that has been thawed and exposed to air. However, some workers have found these compounds may cause the meat to become green in color. This study was made to investigate the effect of several antioxidants, used singly and in combination with the antioxidant sodium ascorbate, on the color and flavor of ground beef preserved by freezing. The antioxidants studied were sodium ascorbate, nordihydroguaiaretic acid, ethylenediamine tetraacetic acid, sodium citrate, and dehydroxy quercetin.

Findings.--In general, ascorbate used alone or in combination with each of the other antioxidants maintained a good color in the thawed samples throughout the 6 weeks of frozen storage. The greening reported by early workers was not observed under the conditions of these experiments. The antioxidants other than ascorbate failed to protect the color of meat during frozen storage under the conditions of these experiments. Thus, sodium ascorbate alone appears to be the most satisfactory additive for color preservation in frozen meat. With the exception of nordihydroguaiaretic acid, which contributed an undesirable flavor, the antioxidants appeared to have little effect on the flavor of the meat.

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EFFECT OF DRYING ON PROTEINS

UNSATURATED MENHADEN FATTY ACIDS

CHROMATOGRAPHIC ASSAY OF FATS

ANTIOXIDANTS FOR FROZEN GROUND BEEF

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methyl esters, and countercurrent distribution for the separation of the free fatty acids. The homogeneity of each of these subfractions with respect to number of double bonds was checked (a) by superimposition of theoretical and experimental countercurrent distribution curves, (b) by ultraviolet spectroscopy after isomerization with alkali, and (c) by gas-liquid chromatography on a polar stationary phase.

Identification of the double-bond structure of the acids in each of the subfractions was accomplished by oxidative ozonolysis with identification of all fragments by gas-liquid chromatography. The fragment from the carboxyl group nearest to the double bond and the fragments between double bonds were identified as dicarboxylic acids, whereas the fragment from the methyl group terminal to the nearest double bond was identified as a monocarboxylic acid. In a few critical cases, terminal fragments were identified and quantified as the 2,4-dinitrophenylhydrazones of the aldehydes produced by reductive ozonolysis. On the basis of these pieces of evidence, the double-bond structures of the acids in each of the subfractions were assigned, and their relative proportions were calculated.

The C_{22} acids could not be separated into clearly resolved peaks by countercurrent distribution. However, gas-liquid chromatography could be used as a preparative method because of the wide separation between pentaenes and hexaenes. The double-bond structure of these fractions was defined by micro-ozonolysis and by gas-liquid chromatography of the mono- and dicarboxylic acids that formed.

Results. -- The fragments isolated by oxidative and reductive ozonolysis of the C_{18}, C_{20}, and C_{22} unsaturated fatty acids in menhaden body oil and the proposed structures of the fatty acids in these groups are described. The C_{16} acids previously described are included for completeness. Seven of the acids listed had not been described before. Thirty references are cited.

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Relationship of structure to properties. --A prerequisite for the formation of a stable gel is a thread-like, or at least a very asymmetrical molecule capable of cross-linking with itself. The native proteins of egg white and of meat and fish must be partly of this type. The fibrous eating quality of meat is a reflection of the fiber structure of the muscle cell, which itself derives from the predominantly fibrous structure of the chief muscle proteins--myosin and actin.

Alterations caused by drying and storage. -- The principle agent that causes the protein to alter is heat. The effect of surface forces and the concentration of such tissue components as inorganic salts, as well as the translocation of potassium in the cell may also cause alterations in the protein. Evidence indicates that the insolubilization of proteins is associated with the deterioration of the physical properties of a protein. Experimental results have suggested that the development of toughness and the decrease in swelling ability during the storage of dehydrated fish is correlated with decreases in protein solubility.

Of the many possible mechanisms that lead to insolubilization there are only two that are supported by experimental evidence: (1) "browning" reactions and (2) the interaction of denatured protein molecules. The reaction of carbonyl compounds, usually carbohydrates, with the amino groups of proteins has been implicated in the development of insolubility during the storage of dried egg, milk, and beef. Observations of these and similar reactions has been interpreted as indicating some cross linkage between the protein molecules, which could lead to insolubility.

Alterations to dried fish muscle proteins. --Even freeze-dried fish fillets, which are the best products so far examined after reconstitution, are noticeably tougher and drier than fresh fish. In dried fish, the protein gel system is disorganized and the true water-binding capacity of the proteins is greatly reduced. Depending mainly upon the temperature and moisture content, dehydrated fish becomes progressivley tougher and drier in texture during storage. This behaviour can be interpreted as indicating the progressive formation of rather firm cross-links between the individual molecules of the protein gel network.

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per minute at the column exit. Column II was packed with 3.5 g. of the succinate polyester applied on 10.6 g. of Celite 545. Column II was operated at 240° C. and 40 pounds per square inch gage of helium at a flow rate of 45 ml. per minute at the column exit.

Estimation of percentage of components. -- The percentage composition by gas-liquid chromatography was obtained by measuring the area under each peak with a planimeter and calculating the ratio of these areas to the sum of the area under all of the component peaks.

Samples. -- Individual fatty acid methyl esters used in known mixtures ranged from 98 to 99 + percent pure, as judged by independent analysis.

The methyl esters of the fats and oils were prepared and freed of unsaponifiables by a method described by Luddy et al. (1959).

Results and discussion. -- Known pure fatty acid methyl esters and mixtures of these were employed to establish satisfactory operating conditions and to obtain reference data.

The calculated compositions show a good order of agreement with the known percentages and with those determined by the spectrophotometric method. Somewhat low values were obtained for the slower-moving polyunsaturated acid esters, and correspondingly high values were obtained for the faster-moving saturated components. A typical chromatogram of lard methyl esters obtained from pigs fed a high level of safflower oil showed a large proportion of methyl linoleate. The presence of some tetraenoic acid ester in the material collected beyond 25 minutes of retention time was detected by the alkali-isomerization spectrophotometric method.

In general, the results of gas-liquid chromatography analyses, where comparisons can be made, are in good agreement with analysis by the spectrophotometric and iodine value method. The authors were unable to determine minor amounts of arachidonic and pentaenoic acids in lard by gas-liquid chromatography.

4.13 CHEMICAL STUDIES ON THE HERRING (CLUPEA HARENGUS) III. THE LOWER FATTY ACIDS

Hughes, R. B. (Torry Research Station, Aberdeen, Scotland)
Journal of the Science of Food and Agriculture 11, 47-53 (January 1960)

Introduction.--Several studies have been made of the steam-volatile acid fraction of fatty fish, but the information obtained has been concerned with the fraction as a whole rather than with the individual acids. According to Hillig and Clark (1938), the freshest salmon and tuna contain some formic acid and acetic acid that increases during spoilage; whereas traces of propionic acid and n- and isobutyric acid appear at later stages. Hillig applied the method to a study of quality in canned herring roe and canned sardines, and he found that it was a satisfactory method. Clague (1942) studied the behaviour of the volatile acid fraction in sardines before and during canning. Charnley (1945) concluded that the volatile acid fraction and the acid value of the oil were equally suitable for assessing quality in herring both before and after canning.

The present paper forms part of a study of the factors that affect the quality of canned British herring. Gas chromatography offers a new analytical approach in this field, and the method of James and Martin (1952) for separating volatile acids has been used for detecting and estimating individual acids.

Analysis by gas chromatography.--Minced flesh (20 g.) was macerated in a Nelco homogenizer with four successive 50-ml. portions of 80 percent alcohol (four volumes of ethanol to one volume of water). The extracts obtained were combined, made up to a final volume of 250 ml. with 80 percent alcohol, filtered, and stored at -30° C. until used. Lower fatty acids in the combined extracts were concentrated and transferred to a nonaqueous medium before they were analyzed.

Results of post-mortem changes.--Changes occurring during post-mortem spoilage were followed

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 ABSTRACTER: Martin Heerdt

4.91 THE FATTY ACID COMPOSITION OF CHYLOMICRONS OF CHYLE AND SERUM FOLLOWING THE INGESTION OF DIFFERENT OILS

Bragdon, J. H. and Karmen, A. (National Heart Institute, National Institute of Health, Bethesda 14, Maryland)
Journal of Lipid Research 1, 167-169 (January 1960)

Introduction.--Dole et al. (1959) recently have reported a remarkable constancy in the fatty acid composition of chylomicrons that have been separated from human plasma during the period of absorption of fats that differ greatly in fatty acid composition. This paper reports (1) the analyses of chyle and serum chylomicrons after the feeding of different fats to rats and (2) attempts to confirm Dole's findings.

Methods.--Polyethylene cannulae were inserted in the thoracic ducts of three rats. The following day the rats were fed 1 ml. of coconut oil, olive oil, or cod-liver oil, respectively. Their chyle was collected, and the chylomicrons were isolated and washed as described by Bragdon (1958). Rat serum chylomicrons were obtained from three groups of four fasting rats, each of which was fed one of the three oils and was bled from the aorta 3 hours later. Blood from each group of rats was pooled, and the blood serum obtained was treated in essentially the same manner as the chyle.

Two young women who had been on a mixed diet limited to 35 g. of fat per day were fed a formula breakfast containing a single fat source that consisted of either coconut oil or corn oil at the rate of 2 g. per kg. of body weight. The women were bled while fasting and again 6 hours postprandially. Their serum samples were treated by layering and washing in a saline solution that contained 0.01 M phosphate buffer at pH 7.4 and 0.05 percent of the disodium salt of ethylene diamine tetraacetic acid. Centrifugation was carried out for 30 minutes at 26,000 times gravity, and the chylomicrons were subjected to three washings in addition to the original separation.

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 ABSTRACTER: Martin Heerdt

4.89 POSSIBILITIES FOR APPLYING FISH OIL TO ORE FLOTATION

Stansby, M. E. (U. S. Bureau of Commercial Fisheries, Seattle 2, Washington)
Commercial Fisheries Review 22, 17-21 (February 1960)

Many years ago fish oils were employed as flotation agents in the concentration of various ores. The specific details of how this was done is not known. A phosphate-flotation plant in Florida is reported to have used fatty acids from menhaden and sardine oils until 1937, when the price of fish-oil fatty acids reached the neighborhood of 12 cents a pound, which was considered to be too expensive. In 1938, tall-oil fatty acids were used to replace the fish-oil fatty acids because of their lower price.

The principal deposits of iron ore in the United States are located in Minnesota and in northern Michigan. During June 1959, the author visited several iron-mining companies and their research laboratories in these two states. The objectives of his visit were (1) to find out if the possibility of using fish oils as flotation agents in the concentration of iron oils is increasing and (2) to develop increased interest by members of the iron-ore industry in the fish-oil research program of the Bureau of Commercial Fisheries.

The purpose of this report is to describe the author's findings and to provide information to the fish-oil industry in regard to future possibilities for marketing their products as ore-flotation agents.

Summary of findings.--1. Problems in concentrating iron ore vary enormously from one geographical area to another. Consequently, the possibilities for applying fish oils as flotation agents differ in the various ore-producing areas.

2. Possibilities for applying fish oils to flotation depend on whether the present or the future is

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 ABSTRACTER: Kathryn L. Osterhaug

6.10 COST AND EARNINGS OF A SMALL TRASH FISH PLANT

Robas, John S.
Fish Boat 5, 35-36 (February 1960)

Labor costs are predicated on two men unloading boats on a part-time basis and one man operating the dryer on a full-time basis. Since most pro-forma balance sheets are based on an 8-hour operating day we will follow this pattern, noting however, that a 1-ton-per-hour plant will operate most profitably when it runs around the clock.

Since the 1-ton-per-hour recycle dryer has been selected as a minimum investment unit, we will also predicate that our unit of measure is the standard fish box, since hand-unloading will be used. The standard wooden fish box, designed to hold 100 pounds of iced shrimp, will hold, on an average, 140 pounds of trash fish. It is also predicated that trash fish are available at one dollar per standard fish box. With these data in mind, let us examine the operation of a typical plant in the 1500-pound-per-hour class.

The small trash fish plant under discussion in this article is designed as an adjunct to an existing shrimp operation and the principle item of expense is the purchase of trash fish from boats. It is considered that the upper level of investment for the machinery and equipment would be $30,000. If the plant under discussion can obtain and process 1800 tons of trash fish per year it will show a gross, annual operating profit of some $16,000 which will serve to amortize the plant in a rather short time.

See table, over.

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FATTY ACIDS IN CANNED HERRING

FISH OIL FOR ORE FLOTATION

FATTY ACID METABOLISM

ECONOMICS OF FISH REDUCTION

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being considered. For the present, fish oils may have little advantage over other ore-flotation agents, since price appears to be the factor determining the choice of agent used. If the future is considered, possibilities for the use of fish oils are greater, since there is likelihood that eventually they will be evaluated on the basis of the efficiency of their action rather than on the basis of their price. (3) Flotation is expanding as a means for concentrating Michigan specularite ores, and three flotation plants are in commercial production. This ore is so highly amenable to being concentrated by flotation that only the cheapest fish oil probably would have a chance for use. (4) Owing to changes made in June 1959 in the Minnesota tax laws, it now has become feasible to consider concentration of certain nonmagnetic taconite ores. Although these ores are much more difficult to float than the Michigan specularite ores, many leaders in the iron-ore concentration industry are considering flotation operations. In difficult operations, fish oils may well have advantages. (5) Some leaders in the iron-ore industry think that magnetically concentrated iron ore eventually may have to be concentrated further. In such an operation, the use of fish oils in a process by which silica is floated from the iron ore may present the best possibility. (6) Need exists for the fish-oil industry to further acquaint the iron-ore industry with the properties of fish oil that might be useful in the flotation of iron ore. (7) The possibilities for applying fish oils as ore-flotation agents in noniron-ore concentrations should not be overlooked. These possibilities include the use of fish oil in the flotation of phosphate and fluorite ores.

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in whole herring held at 10° to 13° C. (ambient temperature) in an aluminum box with a loose lid. The herring were immature fish with an average length of 21 to 22 cm. and were obtained from the Moray Firth in October 1957. Samples of six herring were taken at regular intervals over a period of 4 days and stored at -30° C. pending analysis.

Fresh herring that had been frozen alive in solid CO_2 and then headed contained about 10 ml. of acetic acid, 1 mg. of formic acid, 0.4 mg. of propionic acid, and occasionally a trace (less than 0.03 mg.) of n-butyric acid per 100 g. The identity of these acids was substantiated by adding quantities of individual acids to a mixture prepared from fish flesh and by noting the expected increase in the corresponding zone on the gas chromatogram. Paper chromatography also provided further evidence in support of the identity of the acids, but n-butyric acid could not be detected on paper chromatograms of fresh fish, although it was readily detected in stale fish. Little change occurred during the first 36 hours, after which all acids began to rise rapidly.

During later stages of spoilage (in the sample taken after 72 hours and later samples), isovaleric acid began to appear on the gas chromatograms in very small amounts, and its identity was confirmed by paper chromatography.

To study the evolution of volatile acids, whole Scottish, summer herring were held in cold storage for periods of up to 21 days in contact with (a) normal ice, (b) ice containing 5 p.p.m. of oxytetracycline, and (c) ice containing 5 p.p.m. of chlortetracycline. The presence of antibiotics had no significant effect on the rate of the production of volatile acids or propionic acid. Propionic acid increased from 0.3 mg. to 0.7 mg. per 100 g., whereas n-butyric acid increased from 0.0 to 0.3 mg. per 100 g.

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Here is what the figures show	
Cost of operation (8-hour day)	
Unloading labor, 2 men, 4 hours each at $1.00 per hour each	$ 8.00 per day
Plant labor, one man operating and bagging	8.00 per day
Social Security, payroll taxes, compensation insurance	1.00 per day
Insurance on plant: fire, storm, etc.	1.00 per day
Fuel	
1.2 gallons of No. 2 diesel per 100 lbs. of water evaporated; 16x1.2 gallons = 19.2 gallons per hour; times 8 hours, = 154 gallons at $0.15	$23.10 per day
Electricity (estimate)	2.00 per day
Repairs and maintenance (estimate)	3.00 per day
Burlap bags, used, 45 at $0.15	6.75 per day
Total daily operating cost	$52.85 per day
Daily production	
8 hours x 1600 lbs. of water per hour = 8x1600; = 12,800 lbs. of water evaporated per day. Removing 1480 lbs. of water per ton of fish: 12,800 divided by 1480 = 8.65 tons raw fish.	
At a conversion rate of 4 to 1, this daily in-put will yield; 8.65 divided by 4 = 2.16 tons whole meal.	
Combined cost of production (8-hour day)	
8.65 tons of fish = 17,300 lbs.	
At 140 lbs. per standard fish box, 17,300 lbs. = approximately 123 boxes of fish	
123 boxes trash fish at $1.00	$123.00
Cost of unloading fish and operating plant (see above)	52.85
Combined cost of production	$175.85
Profit and loss	
Gross daily revenue: 2.16 tons whole fish meal at $120.00 per ton	$259.20
Less combined daily cost of production	175.85
Gross daily profit	$ 83.35

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Samples (1) of the fats fed to the rats, (2) of the formula diets fed to the human subjects, and (3) of the chylomicrons collected were extracted in chloroform-methanol as described by Bragdon (1958). Aliquots of the chloroform phase were evaporated to dryness at 20° C. under nitrogen. Methyl esters were prepared by the transesterification procedure of Stoffel et al. (1959). The methyl esters were then extracted into redistilled hexane, and concentrated by evaporation under nitrogen. Aliquots were analyzed by gas chromatography.

Results.--When olive oil or cod-liver oil was fed, the composition of the chylomicrons, whether from chyle or serum, exhibited a remarkable similarity to the dietary fat. When cod-liver oil, which contains very little linoleic acid, was fed the composition of the chylomicrons showed that some linoleic acid was supplied to the intestinal mucosa from nondietary sources. When coconut oil, which contains considerable aluric acid was fed to rats, the chyle chylomicrons showed a significant decrease in their concentration of aluric acid. Bloom et al. (1951) found that only 15 to 55 percent of the lauric acid fed to rats is absorbed via the lymph. Acids shorter in chain length than aluric acid are absorbed through the portal system. For this reason they have been ignored in computing the composition of coconut oil. A comparison of the composition of the chyle chylomicrons with the composition of the coconut oil showed the oleic and linoleic acids were added from nondietary sources. This is the only case in which the serum chylomicrons differed significantly from the chyle chylomicrons. A further reduction in the short-chain acids was accompanied by a relative increase in the 16 and 18 carbon acids.

Corn oil contains long-chain acids exclusively. The fatty acid composition of the serum chylomicrons obtained from two women was almost identical to the fatty acid composition of the corn oil fed in their diet. When coconut oil, with a preponderance of short-chain acids, was fed the result was similar to that observed in the rat and, presumably, for the same reason; namely, that most of the lauric acid was absorbed via the portal system.

4.91 A SUBSTANCE IN LINGCOD LIVER OIL WHICH PREVENTS HYPERCHOLESTEROLAEMIA IN CHOLESTEROL-FED CHICKENS

Wood, J. D. and Biely, Jacob
Nature 185, 473-474 (February 13, 1960)

Introduction. --The serum cholesterol-level in the chicken is elevated above normal by the addition of cholesterol to the diet. In other animals, including the rat, the presence both of cholesterol and of cholic acid is required. De Groot and Reed (1959) showed that cod-liver oil and corn oil prevented the increase in plasma cholesterol in rats caused by dietary cholesterol and cholic acid. Dam et al. (1959) investigated the effect of dietary cod-liver oil and linseed oil in cholesterol-fed chickens and found that both of these oils increased the hypercholesterolaemia caused by the dietary cholesterol. Similar experiments on chickens were performed by Wood and Biely using corn oil, tallow, and various fish oils. Corn oil, tallow, and herring oil were observed to increase the hypercholesterolaemia; but lingcod-liver oil and halibut-liver oil completely prevented the appearance of hypercholesterolaemia. Ratfish-liver oil, dogfish-liver oil, and basking shark-liver oil were intermediate in effect.

Purpose. -- In view of the diverse effects of the oils observed in the chicken studies, further investigations were carried out to obtain additional information about the mode of action of the oils. Corn oil, herring oil, and lingcod-liver oil were chosen for the investigation.

Experimental. -- The oils were saponified with ethanolic potassium hydroxide, and the soap solutions obtained were extracted several times with ethyl ether to obtain the unsaponifiable material. The soap solutions were then acidified with hydrochloric acid, and the free fatty acids were extracted with ethyl ether. Extracts containing the unsaponifiable fractions and the free fatty acids were washed, and the solvent used as an extractant was removed on a water-bath at 70° C. under a stream of

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 ABSTRACTER: Martin Heerdt

4.92 TOXICITY OF AIR-OXIDIZED SOYBEAN OIL

Andrews, John S.; Griffith, Wendell H.; Mead, James F.; and Stein, Robert A. (University of California Medical Center, Los Angeles)
Journal of Nutrition 70, 199-210 (February 1960)

Introduction. --Overheated or oxidized fat causes toxic manifestations in the rat, but neither the exact nature of materials causing these symptoms nor the specific mechanism by which they are caused have been understood with any certainty. Work prior to 1940 established that highly oxidized fat accelerates the destruction of a large variety of essential nutrients (Burr and Barnes 1943). Subsequent work, however, has indicated that certain oxidized oils contain materials that are toxic to the rat even when apparently adequate steps are taken to protect the easily oxidizable foodstuffs in the diet.

Several groups of investigators have changed the chemical nature of oils primarily by means of heat treatment, often with complete exclusion of air. Other groups of investigators oxidized various oils by aeration but did not elevate the temperature during the oxidation process. When the investigators that fed heat-treated oil measured the peroxide content of their product, the peroxide concentration in the toxic oil was found to be very low compared with values obtained with aerated oil.

In the experiments to be reported in this paper, an attempt was made to reconcile apparently contradictory results and, further to identify the toxic mechanism or mechanisms that so frequently lead to death in the rat.

Experimental. -- Various levels of peroxidized oil were fed to determine the levels of toxicity and

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 ABSTRACTER: Martin Heerdt

6.190 STUDIES ON PROTEIN CONCENTRATES FOR ANIMAL FEEDING

Bunyan, J. and Price, S. A.
Journal of the Science of Food and Agriculture 11, 25-37 (January 1960)

Introduction. --Protein concentrates are used as supplementary sources of protein in the rations of farm livestock and these concentrates differ widely in nutritive value. The term protein concentrate includes not only materials of animal origin, such as fish meal, meat meal, and whale meal but also the oil cakes and extracted meals as well as the leguminous grains or pulses.

Protein quality of whalemeat meals. --Six whale meals in the 80 to 90 percent crude-protein range, five in the 70 to 80 percent range, and five in the 50 to 60 percent range were assayed for protein quality. One exceptional whale meal assayed 25 percent crude protein (14 percent true protein), 14 percent fat, and 53 percent ash. In all of the other samples, true protein nitrogen accounted for 77 to 95 percent of the total nitrogen. Meals highest in protein were the lowest in ash.

Available lysine as determined by the dinitroflurobenzene method of Carpenter and Ellinger (1955) showed a range of 5.1 to 7.3 g. per 16 g. of nitrogen with two lower values of 4.0 and 4.5 g. The methyl chloroformate modification of the above method, which often gave higher results, probably because of less destruction of amino acid, showed a range of 3.3 to 8.1 g. per 16 g. of nitrogen. Miorobiological determination of total lysine, where applied, showed an availability of 41 to 84 percent when compared with the modified method, and gave results comparable with a value of 2.6 g. per 16 g. of nitrogen as obtained by Block and Weiss (1956).

The Orange-G-binding data expressed as mg. of dye per g. of sample were correlated with percent of crude protein. Net protein-utilization values were in the range of 17 to 62, and only two were below 30. Eleven meals produced weight gains in the test rats, whereas three others led to

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 ABSTRACTER: Martin Heerdt

7.43 ABSORPTION OF ATMOSPHERIC MOISTURE BY FREEZE-DRIED PORK AND FISH

Matheson, Norman A. (Ministry of Agriculture, Fisheries and Food, Research Establishment, Greyhope Road, Aberdeen, Scotland)
Nature 184, 1949-1950 (December 19, 1959)

Introduction. -- Recent work in the author's laboratory has re-emphasized the need for low moisture content in dehydrated meat and fish if these are to have a long storage life. However, moisture determinations on foodstuffs dried to a low moisture-level by the accelerated freeze-drying process gave erratic results. The method used was to grind the material to a powder in a household mincer; portions of this powder were weighed into moisture tins which were then held for 5 hr. in a vacuum oven at a temperature of 70° C. (158° F.) and a pressure of less than 3 mm. mercury. During this period, a very slow stream of air dried over sulphuric acid was allowed to leak into the oven.

Experimental. -- The above method was modified so that the exposure of the foodstuff to air was reduced to a minimum by keeping material in air-tight jars from the moment of preparation until analysis, and grinding it directly into weighed moisture tins.

Results. --The results became more reproducible and the duplicates better, which indicated that the absorption of atmostpheric moisture was the cause of the previous difficulties. To confirm this, the rate of uptake of moisture of dehydrated pork and dehydrated cod was followed by weighing, at intervals, samples exposed in open dishes. These samples consisted of cubes roughly 2 cm. in size or of powder spread in a layer about 0.5 cm. deep. The initial and final moisture contents were also determined; the initial moisture content plus the gain in weight gave a theoretical final moisture

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the toxic symptoms. Peroxidized oil was fractionated into separate peroxide and polymeric material, and each of these fractions was fed separately. The absorption of peroxidized oil was studied and an attempt was made to ascertain the site of the damage. Unless otherwise noted, weanling rats were fed diets containing air-oxidized soybean oil. The animals were individually housed in suspended cages; and, where pertinent, individual diet consumption records were kept. Each rat was weighed twice weekly.

Two diets were utilized in the growth experiments. The percentage composition of diet A was casein, 25; sucrose, 46; salt mixture, 4; brewers yeast, 5; and fat, 20. The percentage composition of diet B was casein 18, sucrose 60.8, glycerol 1.0, l-cystine 0.2, salt mixture 4.0, and vitamin mixture 1.0. Semiweekly administration to each rat of 175 United States Pharmacopoeia units of vitamin A, 35 units of vitamin D, and 1.75 mg. of α-tocopherol acetate dissolved in 0.05 ml. of sesame oil were provided to satisfy the fat-soluble vitamin requirement.

Results.--Growth studies demonstrated that the concentration of the toxic principle corresponded closely to the peroxide concentration of the oil. Moreover, separation of the oxidized oil into high-, medium-, and low-peroxide fractions revealed that toxicity again followed peroxide concentration.

Histopathological examination of rats fed oxidized soybean oil gave generally negative findings but indicated that the intestine might be involved. Moreover, absorption of fatty acid peroxides in mature rats, studied by means of thoracic-duct cannulation, indicated that, although the reduced products of the peroxides were absorbed, the peroxides themselves were destroyed in the intestine and probably had their action at that site. Recovery from the effects of whole-body irradiation, a condition also affecting the intestine, was delayed by diets containing fat with peroxide numbers as low as 100.

Inhibition of intestinal xanthine oxidase by air-oxidized soybean oil and its reversal by exogenous flavin adenine dinucleotide suggests that the specific toxicity of the lipid peroxides may be at the level of the intestinal enzymes.

7.43 (Cross References: 3.64)

content that could be compared with the amount of moisture determined, thus checking the accuracy of the methods.

Discussion.--It is clear that the uptake of moisture by both pieces and powder is very rapid. Exposure of the sample to the atmosphere, especially after grinding, would have a very marked effect on the accuracy and reproducibility of moisture determinations. Unless particular attention is given to this point, moisture determinations in well-dried foodstuffs will give figures appreciably higher than the true values.

Conclusions.--These results have applications in a wider field than laboratory moisture determinations. They emphasize the known desirability of handling freeze-dried materials such as proteins, enzymes, sera and bacterial cultures in such a way that exposure to moist air is at a minimum. They are also relevant to the commercial dehydration of food to low moisture contents. The difference between the storage life of dehydrated meat or fish at 2 percent and at 4 percent moisture is several months at 37° C. (100° F.). Under temperate conditions, the difference is likely to be measured in years, and it is therefore of considerable importance that the dried foodstuff should not be allowed to pick up appreciable moisture.

4.91

nitrogen. The oils and their components were added to a diet containing 1 percent cholesterol. This diet was fed to 2-week-old New Hampshire chickens for 9 days. At this time, blood samples were taken, and the serum cholesterol concentrations were determined. The oils were fed at a 10-percent level in the diet. The unsaponifiable substances and the free fatty acids were added in amounts approximating those obtained from equivalent amounts of oil.

Results.--As observed previously, lingcod-liver oil prevented the hypercholesterolaemia caused by dietary cholesterol; and herring oil and corn oil stimulated the rise in serum cholesterol-concentration (see table 1, below). The free fatty acids from all three oils markedly increased the degree of hypercholesterolaemia, whereas the unsaponifiable material from herring oil and corn oil produced only a slight increase or none at all. The unsaponifiable material from lingcod-liver oil completely prevented a rise in serum cholesterol. The active material has not as yet been identified; but a possibility exists that it may be vitamin A or perhaps a sterol-type compound that acts in a manner similar to cholestanol.

Table 1.--Effect of various oils and fractions from these oils on levels of serum cholesterol in cholesterol-fed chickens

Addition to the cholesterol-containing diet	Level of serum cholesterol (mgm./100 ml.)*
None	192 ± 12
Corn oil	784 ±173
Herring oil	648 ±133
Lingcod-liver oil	130 ± 31
Corn oil fatty acids	793 ±144
Herring oil fatty acids	618 ±215
Lingcod-liver oil fatty acids	702 ±158
Corn oil unsaponifiables	193 ± 21
Herring oil unsaponifiables	237 ± 34
Lingcod-liver oil unsaponifiables	119 ± 17

*Each value is the mean for four composite samples of serum ± the standard deviation.

6.190

considerable weight losses. Digestibility coefficients ranged between 0.73 and 0.92 for all meals tested except one that had a coefficient of 0.54 and the lowest available lysine, or a value of 3.3 g. per 16 g. of nitrogen, as well as the lowest Orange-G-binding and Streptococcus faecalis values. For the general range of whale meals, biological values were closely related to the available lysine.

Protein quality of fish meals.--Eleven of the fish meals fell into the normal 60 to 73 percent crude protein range, with high proportions of true protein; but two other meals, one of which was a shellfish meal, were exceptional because of their low protein content. The dye-binding data expressed as mg. of dye per g. of sample were linearly related to percent of crude protein percent. When expressed as acid equivalents of dye per 10^4 g. of protein, the data were divided between a group of normal values and a group of low values, which correspond exactly with the normal protein content of the samples and with their net protein utilization values.

Except for two low protein meals, available lysine values were high and comparable with a value of 8.8 g. per 16 g. of nitrogen as given for total lysine by Block and Weiss (1956). Values of 2.8 to 3.0 g. per 16 g. of nitrogen given by Block and Weiss (1956) for methionine were higher than the values reported in this study. Fish meals with 60 to 73 percent protein had biological values in the range 49 to 80. Three fish meals with a normal amount of protein had digestibility coefficients of about 0.8, whereas four other fish meals had coefficients of about 0.9. The evidence obtained here suggests that fish meals of low protein content are of poor quality. Fifty-three references are cited.

7.53 A SPECIFIC GRAVITY METHOD FOR DETERMINING FITNESS (CONDITION) IN HERRING (CLUPEA PALLASII)

Tester, Albert (Pacific Biological Station)
Journal of the Fisheries Research Board of Canada 4, 461-471 (February 1940)

The word "condition" has been used to describe the degree of well-being of a fish, and various factors for determining condition have been calculated. Hile has determined it by means of the factor K in the equation $K = W/L^3$, where W is the weight of the fish and L is its length. Hart has determined condition by means of the factor C in the equation $C = W/L^n$, where n is the empirically derived exponent in the general weight-length relationship $W = CL^n$. Hickling has determined it simply by taking the average weight of the fish at one length. Unfortunately, none of these methods is completely satisfactory.

With the specific fishes herring and pilchard, fat content has generally been considered a good indication of their condition. Although significant correlation has been obtained between condition factors and fitness, the increase relationship has not held. That is, forecasts of oil content based on length and weight determinations have not been entirely successful. Thus, if fatness and condition are to be considered as synonymous and if direct oil analyses are to be avoided, a new condition, or fatness factor, is needed.

In working on this problem, the author showed that the fat factor F is related to the specific gravity G of Pacific herring by the formula $F = G/(G-1)$. Both G and F undergo seasonal variations that are probably compensated for in the live fish by an adjustment of the swim bladder.

The author found that the variations in F and G are closely correlated with the variations in the oil content of the herring. As an index of fatness, the factor F was shown to be superior to condition

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 ABSTRACTER: F. Bruce Sanford

6.195 INTERRELATIONSHIPS AMONG DIETARY ENERGY, PROTEIN, AND AMINO ACIDS FOR CHICKENS

Leong, K. C.; Sunde, M. L.; Bird, H. R.; and Elvehjem, C. A. (University of Wisconsin, Madison)
Poultry Science 38, 1267-1285 (November 1959)

Morrison, Spencer H.
Feedstuffs 32, 44-45 (February 27, 1960)

Introduction.--A partially purified diet was used in a series of experiments to explore the energy-to-protein ratios in diets supplemented and unsupplemented with amino acids. Studies were made (1) to determine the effect of various energy and protein levels on the requirement of the first limiting amino acid (methionine plus cystine) and (2) to determine the effect of these various dietary variables on body composition.

Experimental.--A protein mixture of one part fish meal, one part gelatin, and three parts casein was used as part of the diet. Varying levels of a stabilized, inedible, choice white grease from pork (with possibly some beef tallow) were used in different diets in varying combinations with ground yellow corn, cerelose, and alphacel, to give the desired protein levels and calorie-to-protein ratios. All diets contained certain constant levels of vitamins, salts, and antibiotics. In most cases the productive energy was maintained at levels of 950, 1210, or 1450 Calories. Protein levels ranged from 17 to 42 percent.

Results.--Regardless of whether or not diets were supplemented with amino acids, the percentage of protein required for best growth increased with the energy level of the diet. Diet supplementation with DL-methionine and creatine hydrate drastically decreased the optimum protein level required at the various energy levels. Unsupplemented diets on an average required 27, 29, and 32

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 ABSTRACTER: Martin Heerdt

6.192 THE EFFECT OF DEHYDRATED ALFALFA MEAL, DRIED BREWERS YEAST, CONDENSED FISH SOLUBLES AND FERMENTATION RESIDUE ON THE REPRODUCTIVE PERFORMANCE OF TURKEYS

Whiteside, C. H.; Ferguson, T. M.; Reid, B. L.; and Couch, J. R. (Texas A and M College System, College Station)
Poultry Science 39, 77-81 (January 1960)

Introduction.--Soon after the importance of vitamin B_{12} was established (Lillie et al. 1949), evidence was presented to indicate that breeding hens require an unidentified factor for normal reproduction (Olcese et al. 1950). Some of the supplements that have been reported to contain the unidentified factor(s) required for normal hatchability, are pork liver meal, meat meal, fish meal, dried buttermilk, dried skim milk, meat scraps, dehydrated alfalfa meal, distillers dried solubles, dried whey, and condensed fish solubles (Nestler et al. 1936; Dickens et al. 1941; Atkinson et al. 1951, 1953, 1955; Couch et al. 1954; Ferguson et al. 1956; and Feldman et al. 1957).

Experimental.--The following experiment was designed to study the effects of condensed fish solubles, dried brewers yeast, and antibiotic fermentation residue, and dehydrated alfalfa meal on the reproductive performance of Broad Breasted Bronze turkey hens.

One hundred and eight Broad Breasted Bronze turkey hens from a breeding flock were randomly divided into 12 groups of 15 hens each. The hens had been reared on the range and had been fed a complete practical-type diet that contained adequate amounts of all known nutrients and was fortified with sources of unidentified factors. Hens were placed in breeding pens on December 11 and subjected to 14 hours of light per day. Egg production began about January 1.

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 ABSTRACTER: Martin Heerdt

6.195 A BIOASSAY FOR DETERMINING THE NUTRITIONAL ADEQUACY OF PROTEIN SUPPLEMENTS FOR CHICK GROWTH

Hinner, Scott W. and Scott, H. M. (University of Illinois, Urbana)
Poultry Science 39, 176-183 (January 1960)

Introduction.--In general, the nutritional quality of proteins depends on the proportion and the availability of the amino acids which they contain. Analytical methods presently in use for the determination of the amino acid content of proteins reveal very little information about their availability. A true assessment of the nutritional value of proteins must rely on biological evaluation.

During this evaluation a test protein must be used as a sole source of protein; otherwise, the true value of the protein is masked by a supplemental effect. This study was made to develop an assay capable of practical application and based upon the quantitative growth response of the chick.

Experimental.--Cockerels crossbred from New Hampshire males and Columbian females were used in all experiments. After a pretest period, 13 days of experimental feeding were carried out. The chicks were weighed individually at the beginning of the test, at 7 days, and at 13 days. Feed consumption was determined for each replicate to correspond with an observation period. Feed and water were offered ad libitum except where indicated otherwise. Each cockerel was held in an individual compartment of an electrically heated and thermostatically controlled battery brooder.

The composition of the basal diet used in this study was cerelose 40.00 percent, salts 5.34 percent, refined corn oil 1.00 percent, choline chloride 0.20 percent, vitamins 0.20 percent, and penicillin at the rate of 5 mg. per pound of diet. Variable ingredients such as cerelose, protein sources, and amino acid supplements were adjusted from one experiment to another in order to

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 ABSTRACTER: Martin Heerdt

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Feed and water were supplied ad libitum. The basal diet consisted of 33 percent ground yellow corn, 34 percent ground milo, 25 percent soybean-oil meal, 4 percent defluorinated rock phosphate (18 percent P and 30 percent Ca), 3 percent oyster-shell flour, 0.5 percent sodium chloride, and 0.5 percent vitamin-mineral-medicant mixes. All unidentified factor supplements were substituted for soybean-oil meal and ground yellow corn in such proportions that the calculated crude protein content was the same for all groups of turkey hens. The fermentation residue used was dried extracted penicillin and streptomycin meal with fermentation solubles that contained 1.5 g. of streptomycin sulfate and 0.5 mg. of vitamin B_{12} per pound. After 13 weeks of production, a switchback was initiated to determine the effect of vitamin E and butylated hydroxytoluene on egg production and hatchability. At this time, vitamin E at the rate of 20 mg. per pound and butylated hydroxytoluene at the rate of 0.025 percent were added to all of the diets.

Individual pen matings were made with toms of the same stock and breed. The toms were rotated among the pens at weekly intervals and replaced every 4 weeks. Hens were maintained on the experimental diets for 4 weeks before any eggs were saved for experimental purposes. Eggs were hatched at weekly intervals for 13 consecutive weeks thereafter. Egg production, fertility, feed consumption, and egg size were recorded for 11 additional weeks.

Results.--Supplementations of the basal diet with sources of unidentified factors resulted in an increase in hatchability that ranged from 15.1 percent to 21.8 percent. Dried brewers yeast produced an increase in egg production in the six groups to which it was fed, either singly or in combination with the other supplements. These increases were from 3.9 to 14.4 percent above the production of the basal group. The feeding of vitamin E and butylated hydroxytoluene had no effect on egg production. All supplements studied, both singly and in combination, increased average egg weight from 2 to 7 g. over that of the basal group.

Feed efficiency, based on pounds of feed consumed per egg produced, was improved by feeding dried brewers yeast.

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obtain the desired level of dietary proteins.

Ground coagulated egg white, commercially dried egg white, and an isolated soybean protein (Drackett Assay Protein C-1), were compared for their ability to promote early chick growth. The egg white proteins were supplemented with glycine and arginine, whereas the soybean protein was supplemented with glycine and methionine. After the cockerels had received a corn-soya type ration for 7 days, three replicates of five cockerels each, selected on the basis of 7-day weights, were allotted to each treatment group.

Results.--Growth on the egg white diet was superior at all protein levels. Therefore, with egg white as a reference standard, 15 samples of fish meal were assayed as a sole source of nitrogen in the diets of cockerels at protein levels of 10 and 15 percent. This assay showed greater sensitivity at the 10-percent level of dietary protein than at the 15-percent level and minimum sensitivity at the 30-percent level. The findings suggest that an increase in the dietary protein increases the difficulty of demonstrating amino acid deficiencies.

Striking differences in the nutritional adequacy of the various samples of fish meal were demonstrated by all methods of feeding that were used, but no distinct advantage over ad libitum feeding was shown by any of these methods. Gains in weight resulting from the ad libitum feeding of chicks appeared to be a satisfactory criterion for determining the nutritional adequacy of a protein substance. Gain to feed ratios and gain per gram of protein consumed gave slightly higher variance ratios.

The authors concluded that a chick assay involving three replications of six cockerels on each diet will adequately demonstrate differences in the nutritional adequacy of fish meals if the diet is fed ad libitum at the 10-percent level of dietary protein for a period of 13 days following a 14-day pretest period.

7.53 (Cross Reference: 1.2)

factors calculated on the basis of weight and length.

F may prove to be of value not only in studies on the seasonal changes in the fatness of the fish as a whole but also in studies on the variation in fat content of parts of the fish when analyses are not possible or are not desirable.

The author points out that the method is probably applicable not only to herring but also to pilchard and other oily fish, and with further refinements, possibly to other groups as well.

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percent protein, respectively, for maximum growth at productive energy levels of 950, 1210, and 1450 Calories or Calorie-to-protein ratios of 35.2, 41.7, and 45.3. Amino acid-supplemented diets required 17, 22, and 27 percent protein, respectively, for maximum growth at productive-energy levels of 950, 1210, and 1450 Calories or Calorie-to-protein ratios of 55.9, 55.0, and 53.7.

The best feed efficiency for both the 1450 and 1210 Calorie diets was obtained with 37 percent protein, whereas 32 percent protein gave the best feed efficiency with 950 Calorie diets. Chicks maintained on an optimum Calorie-to-protein ratio for growth apparently consumed enough extra feed to make up for a slight protein deficiency. Chicks maintained on the 17-percent protein level diets developed a severe protein deficiency at the 1450 Calorie energy level, which drastically influenced the feed conversion values for this diet.

The requirement for methionine plus cystine increased (1) as the protein level increased and (2) as the dietary level of energy increased, if the protein level was adequate. Creatine hydrate was effective in replacing all of the L-arginine HCl. Protein was utilized better at each protein level if the next higher energy level was provided. This was particularly true of the balanced protein diets. Apparently adequate energy was required for the protein to exert its maximum influence on growth, but regardless of the energy level an increase in protein decreased the grams of live weight obtained per gram of protein fed. This data when plotted apneared as approximately a 45° slope descending from 17 percent to 42 percent protein.

Until the optimum efficiency Calorie-to-protein ratios were fed, the chicks over-consumed feed to compensate for suboptimal protein and as a result increased their body fat. Body visceral fat deposition and the ether extract of the carcasses were influenced more by the source and the amount of energy than by the Calorie-to-protein ratio. The 1450 Calorie diets provided a high deposition of visceral fat at all protein levels, whereas the 1210 Calorie diets provided high deposition of visceral fat only at the 17 percent protein level and moderate deposition of fat at levels of 22 percent protein or more. Chicks maintained on 950 Calories of energy showed a low deposition of fat at all protein levels.

7.595 THE DETERMINATION OF CHLORTETRACYCLINE IN TISSUES (PARTS I AND II)

Tomiyama, Tetuo; Tsuda, Atsushi; and Yone, Yasuo (Kyushu University, Fukuoka, Japan)
Food Research 25, 97-106 and 106-112 (January-February 1960)

I. AN IMPROVED PAD-PLATE METHOD

Introduction.--Many studies have reported the marked effectiveness of chlortetracycline for the preservation of round fish. The commercial use of chlortetracycline, however, requires approval by the government of the country in which it will be used. To obtain this approval, various workers have surveyed chlortetracycline residues in the flesh of fish that had been subjected to various practical treatments with chlortetracycline. Tomiyama et al. (1957), Kline et al. (1956 to 1957), and Boyd et al. (1956 to 1957) have shown that the chlortetracycline content of the flesh of treated fish is extremely minute and is almost completely destroyed by cooking or heat-processing the fish.

To set a reasonable chlortetracycline tolerance in fish requires a routine assay method that is highly sensitive to minute amounts of chlortetracycline in the flesh. The present paper deals with a proposal for an improved pad-plate method, which method meets the above requirements.

Findings.--Both the sensitivity of the test organism to chlortetracycline and the accuracy of the assay method can be improved (1) by adjusting the pH value of the medium to 5.6, (2) including 3 g. of monobasic potassium phosphate per l. of the medium, and (3) by treating the medium with activated charcoal. The test organism, B. cereus No. 213, is about 2.8 times more sensitive than B. cereus No. 5. Holding the pad-plate in the refrigerator for 1 hour increases the sensitivity of the assay if the extract contains a high concentration of acetone.

A mixture of potassium citrate (pH 5.6) and acetone, when used as an extractant, will recover

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ABSTRACTER: Martin Heerdt

8.59 SPECIES SPECIFICITY OF FISH MUCUS

Barry, J. M. and O'Rourke, Fergus J. (University College, Cork, Ireland)
Nature 184, 2039 (December 26, 1959)

Introduction.--Chromatographic methods have not been used widely in the taxonomic study of fishes. Buzzati-Traverso and Rechnitzer (1953) claimed to have shown that geographical races of marine fishes could be separated by using paper chromatography to analyze muscle-squashes with ninhydrin and fluorescent methods. Later Dannevig (1955), using ninhydrin-stained chromatograms of fresh muscle squashes, found specific differences between various species of Gadidae, Clupeidae and Pleuronectidae. Deep water and inshore forms of Gadus morrhuae were found to be separable. The chromatographic patterns of flatfish hybrids were intermediate between those of the parents but tended more towards the maternal type. Viswanathan and Krishna Pillai (1956), using tissue crushes from fishes that had been dead for some time, demonstrated clear differences between pairs of species in the general Caranx and Leiognathus. They obtained equivocal results with two species of Sardinella.

Wright has shown that snail mucus consists of several chromatographically separable components which fluoresce on exposure to ultraviolet light. He used these patterns in a taxonomic study of the molluscan genus Lymnaea.

Purpose.--We should like to direct attention to the possibilities of the use of chromatographic analysis of fish mucus for taxonomic purposes.

Experimental.--We have found that the simple ultraviolet method described by Wright (1957) can be used to distinguish many species. However, closely related species may require the use of several different solvents, and it may be necessary to examine, not alone the dry chromatogram, but also the wet one, under ultraviolet light. Furthermore, various location reagents may be required.

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Reprinted in whole

7.81 AN EVALUATION OF THE INDOLE AND TRIMETHYLAMINE TESTS FOR OYSTER QUALITY

Lartigue, Donald; Novak, Arthur F.; and Fieger, Ernest A. (Department of Agricultural Chemistry and Biochemistry, Louisiana State University, Baton Rouge)
Food Technology 22, 109-112 (February 1960)

Introduction.--No simple and dependable tests for oyster quality are presently available. Extreme biological differences, seasonal variations, and use of the whole organism in the tests complicate the analytical problems. Need for a measure of oyster quality, long recognized by the industry and by public health officials, has prompted numerous investigations. Most of this research has failed to fulfill the need, but tests for indole and trimethylamine have recently been proposed as possible spoilage indices for oysters. Since indole is formed during the decomposition of proteins, it has been assumed that indole content might parallel spoilage.

Objectives.--(1) To ascertain the applicability of the indole and trimethylamine tests for oysters, modifying them when necessary; (2) to evaluate these tests as indices of oyster quality by comparing them to bacterial counts and organoleptic ratings at various stages of oyster decomposition; (3) to determine the effect of chlortetracycline as a preservative for oysters; and (4) to determine the effect of chlortetracycline on these tests and on the spoilage mechanisms of oysters as evidenced by indole and trimethylamine formation.

Experimental.--(1) Description of oyster quality tests: Oysters were obtained from an oyster plant in New Orleans, shucked, and packed unwashed in metal containers. They were processed by washing in water or in a solution of 20 parts per million chlortetracycline, drained for 5 minutes, and then stored in cans or jars in crushed ice. (2) Determination of indole: The indole test used was essentially that of Duggan and Strasburger (J. Assoc. Offic. Agr. Chemists 29, 177 (1946)). (3)

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ABSTRACTER: Herman S. Groninger

9.4 1957 ANNUAL REPORT OF THE NORWEGIAN FISHERIES RESEARCH INSTITUTE

Heen, Eirik; Villmark, Fredrik; Hjorth-Hansen, Sverre; Aure, Lars; Jebsen, Jens W.; Karsti, Olaf; Bakken, Kare; Sola, Einar; and Braekkan, Olaf (Fiskerilaboratoriet, Bergen, Norway)
Arsberetning vedkommende Norges Fiskerier 1957, pp. 1-56 (1958) (Norway)

Aureomycin and terramycin, 10 mg. per l. used as a dip, enhanced the keeping quality of fish waste for mink feeding, but bacimycin did not. Cod fillets in ice containing aureomycin or terramycin, 5 mg. per l., developed a yellow color. The antibiotics (10 mg. per l.) when used to wash uneviscerated herring contributed very little to their keeping quality and they were of no value either on cod being dried for stockfish or on salt fish infected by red bacteria. Sorbic acid prevented mold on golden-smoked herrings and on light-smoked mackerel fillets. Lumpfish roe, with as little as 6 percent salt, was preserved by the addition of a mixture of 100 g. sodium benzoate and 50 g. hexamethylenetetramine per barrel of roe. Health authorities may object to the use of these chemicals. Butylated hydroxytoluene (0.03 percent) added to herring meal after drying prevented heating and slowed oxidation as measured by the iodine number of the oil. The fat of swine that had been fed meal containing butylated hydroxytoluene contained approximately 2 percent unsaturated fatty acids, whereas that from swine fed untreated meal contained approximately 0.8 percent. This higher unsaturation made such fat more liable to rancidity. However, addition of vitamin E to the feed controlled the problem to a considerable extent. Oil was more easily extracted from meals treated with butylated hydroxytoluene and was of higher quality.

Herring oil for use in the canning industry was refined by furfural extraction, treatment with activated carbon, and cold clearing. It was free of odor and taste and had an iodine number of 120, as opposed to 125 for the unrefined oil. It was less stable than the unrefined oil, but stability was

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ABSTRACTER: R. Paul Elliott

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Determination of trimethylamine: The procedure of Dyer (J. Fish. Res. Bd. Can. 7, 576 (1950)) was used, but modified so that the amine was removed from the oysters by steam distillation. (4) Bacterial plate counts: Weighed samples of oyster meats were blended with an equal amount of sterile distilled water. Serial dilutions were made and aliquots were plated in triplate on Difco Nutrient Agar and incubated for 3 days at 28° C. (5) Organoleptic ratings: Oysters were appraised by two judges for the presence of off-odors, black spots, general appearance, and texture of the meats.

Results and discussion. --Indole content decreased in both the chlortetracycline-treated oysters and control samples during the first 6 days of storage. During 6 to 20 days' storage, the content of indole decreased in some samples and increased in others. The indole content did not reflect deterioration in quality or onset of spoilage, which on the basis of organoleptic ratings occurred about the 18th day.

There is an initial rise in the trimethylamine content of stored oysters, but on continued storage the changes appeared to develop at random.

Conclusions. --Indole and trimethylamine concentrations showed no definite pattern during the storage of oysters. These tests are not recommended for assessment of oyster quality.

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restored by addition of 0.02 percent butylated hydroxytoluene. The unrefined oil was assumed to contain natural antioxidants. Butylated hydroxytoluene protected neither smoked salmon nor fish sticks from rancidity.

A new myogen-group protein that lacked tyrosin and tryptophane but contained 16 percent phenylalanine was isolated from fish muscle by electrophoresis in $(NH_4)_2SO_4$ solution. Four myogen-group proteins were separated from sole meat: (1) needle-shaped crystals from 50 to 60 percent $(NH_4)_2SO_4$, with sedimentation rate (SR) 6.9 to 7.2 Svedberg units (S); (2) rhomboid crystals from 60 to 70 percent $(NH_4)_2SO_4$, with SR 5.5 S; (3) uncrystallized protein from 70 to 80 percent $(NH_4)_2SO_4$ with SR 4.72 S; (4) uncrystallized protein from 90 to 100 percent $(NH_4)_2SO_4$ with SR 1.4 to 1.5 S.

Freezing of fish in the round, followed by thawing, filleting, and refreezing caused a quality drop, particularly when the round fish had been top quality. Thawing the round fish in water resulted in better quality fillets than thawing in air. Freezing cod fillets in vacuum did not improve quality, but the storage life of frozen herring fillets was improved by the use of vacuum. Water loss on thawing of frozen cod was less in: fillets thawed at 3° C. as opposed to 18° C.; in uncut fish as opposed to fillets; in fillets dipped in 6 percent salt + 3 percent sugar before freezing as opposed to undipped controls; in comminuted cod with 1 percent $Na_3PO_4 \cdot H_2O$ or $Na_2HOP_4 \cdot 12\ H_2$) as opposed to controls. The following had no affect on water loss on thawing: skinning of fillets, variations in freshness, addition of phosphates to the above salt and sugar dips.

7.595 (Cross Reference: 3.12)

larger amounts of chlortetracycline than other known extractants. Recovery of chlortetracycline is not dependent on the kind of fish, its freshness, or the chlortetracycline content of its flesh. Chlortetracycline when dissolved in the citrate-acetone mixture gives nearly identical growth inhibition to B. cereus either in the presence or absence of tissue extracts. Chlortetracycline, when dissolved in the citrate-acetone mixture, can be protected from deterioration due to ferric ion. None of the food preservatives tested interfered with the pad-plate assay method for chlortetracycline.

II. AN IMPROVED CYLINDER-PLATE METHOD

Introduction. --Chlortetracycline in blood serum and urine can be determined easily by the cylinder-plate method, since no previous extraction of the antibiotic is necessary (Grove and Randall 1955). However, in the case of chlortetracycline-containing tissues, difficulties have been experienced in obtaining a high recovery of chlortetracycline and also in preventing the aqueous sample extract from putrefying during the incubation of the test plate. The present study was undertaken to determine (1) the best procedure for extracting chlortetracycline-containing tissues to obtain maximum recovery of the antibiotic and (2) the conditions necessary for establishing a high sensitivity to chlortetracycline when the cylinder-plate method is used.

Findings. --A mixture of acetone and citrate buffer was used (1) for the extraction of chlortetracycline from sample tissues and (2) as the diluent of the standard chlortetracycline solution. The method provided a recovery of 95 percent in several kinds of fish flesh and a sensitivity of 0.002 μg. per ml.

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Results. --For example, Gadus pollachius mucus can be distinguished from the mucus of Gadus virens by the fact that the latter leaves no fluorescent material at the point of application after running with butanol acetic acid, whereas the former leaves a pink fluorescent material at the origin. On the other hand mucus from Sebastes marinus and Sebastes mentella produced similar fluorescent patterns after running with butanol acetic acid and showed eight identical bands after treatment with ninhydrin. However, on viewing under ultraviolet light while still wet at the end of a run in phenol ammonia solvent, the diffuse outermost band (that is, the band with the highest R_f value) is split in the former species (marinus) by an evanescent absorption band not seen in the latter (mentella). After drying, the split band of marinus is no longer detectable as it is replaced by a single diffuse band as in mentella. Ninhydrin-staining of the chromatogram produced by running in phenol ammonia gives 10 identical bands in both species. Running in phenol water gives a fluorescent band in marinus with an R_f value of 0.21, not shown by mentella.

0.32 POST-MORTEM CHANGES IN THE WATER SOLUBLE PROTEINS OF BOVINE SKELETAL MUSCLE DURING AGING AND FREEZING

Kronman, M. J. and Winterbottom, R. J.
Journal of Agricultural and Food Chemistry 8, 67-72 (January-February 1960)

(Abstract of this article appears under 3.239 page 11 - May 1960)

0.32 LOCALIZATION OF CONTRACTILE PROTEINS IN THE MUSCLE OF THE HORSESHOE CRAB (LIMULUS POLYPHEMUS)

DeVillafranca, G. W.; Scheinblum, T. S.; and Philpott, D. E. (Smith Coll., Northhampton, Mass.)
Chemical Abstracts 53, 19005c (October 25, 1959)

0.32 AN ELECTROPHORETIC STUDY OF THE SQUID ACTOMYOSIN

Matsumoto, Juichiro J.
Bulletin of the Japanese Society of Scientific Fisheries 25, No. 1, 27-37 (1959) (In English)

This paper deals with some electrophoretic studies performed to confirm the identity or non-identity of actomyosin-like protein from squid with actomyosin from rabbit and carp. Measurements made on carp actomyosin were used as controls.

1.0116 A BIOLOGICAL EVALUATION OF THE DELAWARE RIVER ESTUARY

Shuster, Carl N., Jr. (University of Delaware Marine Laboratories)
Information Series, Publication No. 3, 77 pp. (September 1959) (University of Delaware Marine Laboratories, Newark, Delaware)

1.0116 THE POUND-NET FISHERY IN VIRGINIA PART 2 - SPECIES COMPOSITION OF LANDINGS REPORTED AS MENHADEN

McHugh, J. L. (U. S. Bureau of Commercial Fisheries)
Commercial Fisheries Review 22, 1-16 (February 1960)

1.37 TECHNICAL NOTE NO. 47.--STEELHEAD TROUT DESCRIPTION AND PROXIMATE COMPOSITION

Iverson, John L.
Commercial Fisheries Review 20, 26-27 (November 1958)

(Abstract of this article appears under 8.0 page 11 - April 1959)

1.37 KEEPING RAINBOWS IN COLD STORAGE

Nelson, Richard W.
U. S. Trout News 4, 11-12 (November-December 1959)

(Abstract of this article appears under 3.2381 page 7 - April 1960)

2.01 HISTIDINE DECARBOXYLASE OF HALOPHILIC BACTERIA. THE ISOLATION OF HISTAMINE-PRODUCED HALOPHILIC BACTERIA (NEW SPECIES) FROM FRESH FISHES

Yanagisawa, Fumiyoshi; Takeuchi, Tadaya; Yamawaki, Masaki; Kawashima, Yasuhiro; Tanaka, Kyomaro; Hirose, Shuji; Kiribuchi, Tatsuji; and Dei, Saburo (Univ. Tokyo)
Chemical Abstracts 53, 8275f (May 10, 1959)

2.01 BACTERIOLOGICAL STUDIES ON THE SPOILAGE OF FISH SAUSAGE I. NUMBER OF BACTERIA PRESENT IN THE MEAT OF FISH SAUSAGE ON THE MARKET

Akamatsu, Mikio
Bulletin of the Japanese Society of Scientific Fisheries 25, 545-548 (November 1959) (English abstract, figures, and tables)

About 80 percent of the samples contain 100 to 1,000 aerobes and 10 to 100 anaerobes per gram of the meat. Bacteria, in all of the samples, increased in number after storage at 30° C. for 2 weeks. The casing used to contain fish sausage does not inhibit the growth either of aerobes or anaerobes.

II. Kinds of bacteria present in the meat of fish sausage on the market.--Ibid. 549-553. Spore-forming rods were predominant in all of the samples. Nonspore-forming rods and cocci were found only in about one-third of all the samples. Bacterial flora isolated from the deteriorated samples were Bac. subtilis, Bac. pumilus, and Sarcina flava. Bacteria isolated from nondeteriorated samples were Bac. coagulans, Bac. firmus, Bac. lentus, Bac. circulans, Bac. michaelisii, Bac. kaustophilus, and Flavo invisible.

GLOSSARY OF COMMON AND SCIENTIFIC NAMES OF FISH AND SHELLFISH*

Common name	Other common names	Scientific name
Alewife	Branch herring, big-eyed herring, river herring,	Pomolobus pseudoharengus
	Blueback, glut herring, shad herring	Pomolobus aestivalis
Anchovy		Engraulis mordax
Cod	Codfish	Gadus morhua (Atlantic)
		Gadus macrocephalus (Pacific)
Flounder:		
Gray sole		Glyptocephalus cynoglossus
Lemon sole		Pseudopleuronectes dignabilis
Yellowtail	Dab	Limanda ferruginea
Dab	Sea dab	Hippoglossoides platessoides
Blackback	Winter flounder	Pseudopleuronectes americanus
Fluke	Summer flounder, gulf flounder, flounder	Paralichthys species
'Sole'		Pleuronectidae and Bothidae species
'California halibut'		Paralichthys californicus
Haddock		Melanogrammus aeglefinus
Halibut		Hippoglossus hippoglossus (Atlantic)
		Hippoglossus stenolepis (Pacific)
Herring:		
Lake	Herring	Leucichthys artedi (Great Lakes, except Erie)
Round		Etrumeus sadina
Sea		Clupea harengus (Atlantic)
		Clupea pallasii (Pacific)
Thread		Opisthonema oglinum
Jack mackerel	Horse mackerel	Trachurus symmetricus
Lingcod	Cultus cod, blue cod, buffalo cod, ling	Ophiodon elongatus
Mackerel		Scomber scombrus (Atlantic)
		Pneumatophorus diego (Pacific)
Menhaden	Mossbunker, pogy, fatback	Brevoortia species
Mullet	Jumping mullet, striped mullet, silver mullet	Mugil species
Ocean perch:		
Atlantic	Rosefish, redfish, red perch	Sebastes marinus
Pacific		Sebastodes alutus
Pilchard	Sardine	Sardinops caerulea
Pollock	Boston bluefish	Pollachius virens
Rockfish	Rock cod, snapper	Sebastodes species (Pacific)
Sablefish	Black cod	Anoplopoma fimbria
Salmon:		
Atlantic		Salmo salar (Atlantic)
Pacific:		
Chinook or king	Tyee, spring	Oncorhynchus tshawytscha
Chum or keta	Fall, dog	Oncorhynchus keta
Pink	Humpback	Oncorhynchus gorbuscha
Red or sockeye	Blueback	Oncorhynchus nerka
Silver or coho		Oncorhynchus kisutch
Spanish mackerel	Mackerel	Scomberomorus maculatus
Tuna and tunalike fishes:		
Albacore	Longfin tuna	Germo alalunga
	---	Thunnus saliens
Bluefin	Horse mackerel	Thunnus thynnus
	---	Thunnus secundodorsalis
Bonito		Sarda sarda (Atlantic)
		Sarda chiliensis (Pacific)
Little	Bonito, albacore, false albacore	Euthynnus alletteratus
Skipjack	Striped tuna	Katsuwonus pelamis
Yellowfin		Neothunnus macropterus
Whiting	Silver hake	Merluccius bilinearis
Crab:		
Blue		
Hard	Hard-shelled crab	Callinectes sapidus
Soft and peelers	Soft-shell crab	Callinectes sapidus
Dungeness		Cancer magister
King	Alaska king crab	Paralithodes camtschatica
		Cancer irroratus (New England)
Rock		Cancer species (California)
Stone		Menippi mercenaria
Lobster:		
Northern		Homarus americanus (Atlantic)
Spiny	Sea crawfish, rock lobster	Panulirus argus (Atlantic)
		Panulirus interruptus (Pacific)
Shrimp	Prawn	Penaeus setiferus (South)
		Penaeus duorarum (Atlantic)
		Penaeus aztecus and Xiphopeneus kroyeri Gulf)
		Pandalus species (Atlantic and Pacific)
		Pandalopsis species (Pacific)
		Crago species (Pacific)
Clam:		
Cockle		Cardium corbis (Pacific)
Coquina	Pompano shells	Donax variabilis
	Butter	Saxidomus nuttali (Pacific)
Hard	Little neck	Paphia staminea (Pacific)
	Round clam, cherrystone, quahog, little neck	Venus mercenaria (Atlantic)
		Venus mortoni (Florida)
Ocean quahog		Cyprina islandica
Pismo		Tivela stultorum (Pacific)
Razor		Ensis species (Atlantic)
		Siliqua patula (Pacific)
Soft	Soft-shell clam, sand clam, nannynose, maninose	Mya arenaria
Surf	Skimmer	Spisula solidissima
Oyster:		
Eastern	Cove	Crassostrea virginica
Pacific (introduced)	Japanese	Crassostrea gigas
Western	Olympia, native	Ostrea lurida
Scallop:		
Bay		Pecten irradians (Atlantic)
		Pecten aequisulcatus (Pacific)
Sea		Pecten magellanicus

* Taken from Fishery Statistics of the United States 1955. Each species listed was caught in excess of 10,000,000 pounds in 1955.

2.111 CALCULATING THE WEIGHT OF COTTON NETS UNDER CONSIDERATION OF A CERTAIN HANGING COEFFICIENT

Schmidt, K. and Auwand, K.
Deutsche Fisherei Zeitung 5, No. 4, p. 100 (April 1958) (In German)
World Fisheries Abstracts 10, 17-18 (July-August 1959)

The weight of a net section can be calculated after the formula: $\text{weight} = \frac{L \cdot T \cdot C}{100 \cdot 100}$

In this formula "L" means the length of the net section in meters, "T" is the height in meshes and "C" is a constant factor, which changes depending on the type and number of the net twine as well as of the size of mesh. These factors were found empirically. They refer to the stretched net. The nets are used in various hangings, for instance, 1 : 2, that means that 100 m. (109 yds) of net fastened to the lines make only 50 m. (55 yds) in length.

2.111 THE DISTRIBUTION OF STRESS ON THE FISHING NET I. ON THE STATIC LOAD

Kondo, Yasushi and Suzuki, Makoto
Bulletin of the Society of Scientific Fisheries 25, 519-524 (November 1959)

When a vertical load is imposed on a net knot, the distribution of tension becomes rhombic in shape. If the tension that appears on the leg line starting at the loaded point is denoted by T, the following equation will apply:

$$\frac{T}{W} = Kt + K_a \exp(-k(n-1))$$

2.119 SURVEY INDICATES MANY BOATS CARRY MINIMUM SURVIVAL GEAR

Anonymous
Fish Boat 4, 28-29, 44 (September 1959)

2.119 INFLATABLE LIFE RAFTS AID RESCUE AT SEA

Anonymous
National Fisherman 41, 10, 32-33 (March 1960)

From the standpoint of performance and economy, inflatable life rafts are writing one of the most dramatic chapters of maritime history. It has been proved that they can be launched without trained crews under any conditions, they are easy to board, they are not subject to breaking up against vessels or rocks, and they offer covered protection to survivors. The latter is most important, because far more persons involved in marine casualties die from exposure than from drowning. The inflatable life rafts are excellent for transferring passengers from vessel to vessel or vessel to shore, and they are stable and easily handled.

2.15 STUDIES ON THE INFLUENCE OF TREATMENTS IMMEDIATELY AFTER CATCHING UPON THE QUALITY OF FISH FLESH I. EXAMINATIONS ON KILLING AND STORING METHODS FOR KEEPING QUALITY OF MACKEREL, DACE, AND CARP

Tsuchiya, Yasuhiko; Sato, Yoshio; Suzuki, Yoshio; Nakano, Tomoo; Kudo, Hidero; Sasaki, Takashi; Murase, Masahiko; and Yamazoi, Kenichi
Bulletin of the Japanese Society of Scientific Fisheries 25, 373-380 (September 1959) (English abstract and tables)

Freshness of fish was evaluated by organoleptic methods and by an estimation of volatile basic-N, trimethylamine-N, pH, and firmness of flesh. Fish immersed in ice-saline water containing 1 percent NaCl and 0.01 percent butylated hydroxyanisole kept best of all. In these tests, crusted ice was the least suitable method of holding fish.

II. Further examinations of treatments on keeping quality of fish. --Ibid. 381-386. The freshness of dressed fish that had been dipped in sea water containing 20 p. p. m. of chlortetracycline for 2 minutes and sealed into a polyethylene tube was superior to fish subjected to all other holding treatments. Immersion in ice water was not as suitable as (1) icing with 1 percent sodium chloride or (2) immersing in ice water containing 1 percent sodium chloride.

III. Effect of several treatments on keeping quality of bass meat. --Ibid. 387-391. The appearance of dressed fish that had been sealed in polyethylene tubes was excellent in the early stage of storage with regard to dehydration and oxidation, but the freshness of these fish was not always satisfactory after long storage.

2.9 BIOCHEMICAL STUDIES ON SQUID MEAT FOOD POISONING III. THE EFFECT OF AMINES OF SQUID MEAT ON THE ACTIVITY OF HUMAN SERUM ACETYLCHOLINESTERASE

Murata, Kiichi; and Iida, Atsushi
Bulletin of the Faculty of Fisheries, Hokkaido University 10, 77-81 (May 1959) (English abstract, figures, and tables)

Three amine fractions: total, volatile, and nonvolatile, were obtained from squid meat that had been kept at 27° C. Each of these fractions was added to an enzymic reaction medium. With each fraction, inhibition to acetylcholinesterase activity increased in proportion to the content of amines. Meat that had been kept at 27° C. for 0 and 24 hours could be eaten. Total amines from meat held at 27° C. gave 3.5 and 10 percent inhibition of acetylcholinesterase activity, respectively.

2.9 THE ADDITION OF GROUND FISH, FEED YEAST AND ANTIBIOTICS TO FODDER COMBINATIONS FED TO GROWING PIGS

Kabozov, S. M.; Antonov, A. A.; and Gerasimov, S. Ya.
Chemical Abstracts 53, 22588d (November 25, 1959)

2.9 BIOLOGICAL VALUE OF FISH PROTEIN IN NUTRITIONAL EXPERIMENTS WITH THE NEW-BORN ANIMALS

Gruttner, R. and Schafer, K. H. (Univ. Hamburg-Eppendorf, Ger.)
Chemical Abstracts 54, 3623d (March 10, 1960)

CONVERSION UNITS

1 pound = 453.59 grams

1 ounce = 28.350 grams

1 inch = 2.5400 centimeters

1 gallon = 128 ounces

1 gallon = 231 cubic inches

1 quart = 0.9463 liters

1 ounce = 29.573 milliliters

CONVERSION OF TEMPERATURE SCALES

$F = 9/5\ C + 32$

$C = 5/9\ (F-32)$

SPECIFIC HEAT AND HEAT OF FUSION

Average values of specific heat generally used for fishery products are 0.80 B.t.u. per pound per °F. above freezing and 0.40 B.t.u. per pound per °F. below freezing.

An average heat of fusion generally used for fishery products is 115 B.t.u. per pound. The heat of fusion of ice is 144 B.t.u. per pound.

DEFINITIONS

calorie	heat required to raise the temperature of 1 gram of water 1 degree Centigrade
British thermal unit	252 calories or the heat required to raise the temperature of 1 pound of water 1 degree Fahrenheit
ton of refrigeration	removal of heat at the rate of 12,000 B.t.u. per hour
atmospheric pressure normal	a pressure at sea level of 14.696 pounds per square inch, absolute
sensible heat	heat added to the body when its temperature is changed
latent heat	heat absorbed or evolved during a change of state, with no change of temperature
heat of fusion	heat absorbed when a solid melts, with no change of temperature
heat of vaporization	heat absorbed when a liquid vaporizes, with no change of temperature
heat of reaction	heat evolved or absorbed during a chemical reaction
heat transmission	flow of heat by conduction, convection, or radiation, singly or in any combination
horsepower	work performed at the rate of 550 foot pounds per second
mechanical equivalent of 1 B.t.u. of heat	heat given off by a total expenditure of 778 foot pounds of energy

COMMON ABBREVIATIONS*

A.	Angstrom unit(s)
a.c.	alternating current
alc.	alcohol, alcoholic
alk.	alkaline (not alkali)
amp.	ampere(s)
anhyd.	anhydrous
aq.	aqueous
at.	atomic (not atom)
at. wt.	atomic weight
Bé.	Baumé
biol.	biological
B.O.D.	biochemical oxygen demand
b.p.	boiling point
B.t.u.	British thermal unit(s)
cal.	calorie(s)
cc.	cubic centimeter(s)
cm.	centimeter(s)
d.	density (d_{13} specific gravity at 13° referred to water at 4°; d_{20}^{20}, at 20° referred to water at the same temperature)
d.c.	direct current
e.m.f.	electromotive force
Et	ethyl (Et_2O, ethyl ether)
e.v.	electron volt(s)
f.p.	freezing point
ft.	foot, feet
g.	gram(s)
γ	microgram(s)
hr.	hour
in.	inch(es)
kcal.	kilocalorie(s)
kg.	kilogram(s)
kv.	kilovolt(s)
kv.-amp.	kilovolt-ampere(s)
kw.	kilowatt(s)
kw.-hr.	kilowatt-hour
l.	liter(s)
lb.	pound(s)
m.	meter(s); also (followed by a figure denoting temperature) melts at, melting at
M.	molar (as applied to concn.)
ma.	milliampere(s)
Mc.	megacycle
mc.	millicurie
Me	methyl (MeOH, methanol)
meq.	milliequivalent
m.e.v.	million electron volts
mg.	milligram(s)
ml.	milliliter(s)
mm.	millimeter(s)
mγ	millimicrogram
mμ	millimicron(s)
mol.	molecule, molecular
mol. wt.	molecular weight
m.p.	melting point
μ	micron(s)
mv.	millivolt(s)
n	index of refraction (n_D^{20} for 20° and sodium light)
N	normal (as applied to concn.)
petr. ether	petroleum ether
p.p.m.	parts per million
ppt.	precipitate
pptd.	precipitated
pptg.	precipitating
pptn.	precipitation
qual.	qualitative (not qualitatively)
quant.	quantitative (not quantitatively)
r.p.m.	revolutions per minute
sol.	soluble
soln.	solution
sp. gr.	specific gravity
sp. heat	specific heat
sp. vol.	specific volume
sq. cm.	square centimeter(s)
U.S.P.	United States Pharmacopeia
v.	volt(s)
vol.	volume (not volatile)
w.	watt(s)
wt.	weight

* These abbreviations are used by Chemical Abstracts and, accordingly, have wide recognition.

3.12 COMPARATIVE EFFECTIVENESS OF VARIOUS CHLORTETRACYCLINE (CTC)-TREATMENTS IN KEEPING QUALITY OF TRAWLED FISH AND CTC RESIDUE ON TREATED FISH

Yone, Yasuo; Tomiyama, Tetuo; and Hamada, Shichiro
Bulletin of the Japanese Society of Scientific Fisheries 25, 156-162 (June 1959) (English abstract, figures, and tables)

3.12 A PRACTICAL ASSAY METHOD FOR DETERMINATION OF TETRACYCLINE AND OXYTETRACYCLINE IN TISSUES

Tomiyama, Tetuo and Oyama, Shigenobu
Bulletin of the Japanese Society of Scientific Fisheries 25, 228-233 (July 1959) (English abstract, figure, and tables)

The Tomiyama et al. (1959) practical assay method for the determination of minute amounts of chlortetracycline in tissues could be used to determine tetracycline and oxytetracycline in tissues by modifying the standard antibiotic solutions. The average recoveries of tetracycline or oxytetracycline in tissues was 88 percent from muscle and 96 percent from skin.

3.12 PLANT-SCALE APPLICATIONS OF CHLORTETRACYCLINE FOR FISH PRESERVATION

Farber, Lionel and Lerke, Peter
Chemical Abstracts 53, 22589f (November 25, 1959)

3.18 USE OF CHLORINE DIOXIDE FOR CANNERY SANITATION AND WATER CONSERVATION

Welch, John L. (Le Seru, Minnesota) and Folinazzo, John F. (Chicago, Illinois)
Food Technology 13, 179-182 (March 1958)

Chlorine dioxide treatment of once-used water is highly effective in controlling bacteria and slime formation in pea and corn canneries. The persistent residuals and the lack of reaction with ammonia nitrogen make possible one-point rather than multiple-point application as required in re-chlorination of used water. Bactericidal residuals maintained in used water do not result in generation of offensive odors in the factory nor do they appear to result in off-flavor in the product. Total bacterialcounts on product were significantly lower when chlorine dioxide was used.

3.18 SANITATION ABOARD FISHING TRAWLERS IMPROVED BY USING CHLORINATED SEA WATER

Linda, Arvey H. and Slavin, Joseph W.
Commercial Fisheries Review 22, 19-23 (January 1960)

(Abstract of this article appears under 2.15 page 9 - May 1960)

3.237 PERMITS DEEP-FAT BROWNING WITHOUT DEEP-FAT METHODS

Anonymous
Food Processing 20, 81 (April 1959)

Infrared cooking of fish sticks permits deep-fat browning without deep-fat cooking methods. Only small amounts of oil are sprayed on fish sticks during cooking operation. A 7-foot long infrared oven is turning out approximately 400 pounds of processed fish sticks per hour. In approximately $1\frac{1}{4}$ minutes, the sticks are properly browned and cooked before being frozen.

3.237 CHANGES IN STABILITY OF OIL DURING DEEP-FAT FRYING

Yamamoto, Yoshiko; Ono, Futara; and Tanaka, Kimi
Chemical Abstracts 53, 22587c (November 25, 1959)

3.2495 (Cross Reference: 1.953)

EFFECT OF DIFFERENCES OF INITIAL AND FINAL TEMPERATURE OF WHALEMEAT WHEN IT IS TAKEN INTO AND OUT OF FREEZER ON DRIP

Tanaka, Kazuo and Tanaka, Takeo (Tokai Regional Fisheries Research Laboratory, Tokyo, Japan)
Journal of the Tokyo University of Fisheries 43, No. 1, 13-17 (1957)

Differences of initial and final temperature of whalemeat during freezing had no appreciable effect on the formation of drip.

3.2495 STUDIES ON MUSCLE OF AQUATIC ANIMALS XXXVIII. THE INFLUENCE OF FROZEN STORAGE ON MUSCLE PROTEIN OF YELLOWTAIL (SERIOLA QUINQUERADIATA)

Simidu, Wataru; Simidu, Usio; and Terasima, Hiroyoshi (Kyoto University, Maizuru, Japan)
Bulletin of the Japanese Society of Scientific Fisheries 23, No. 11, 700-703 (1958) (In English)

ADDRESSES OF PUBLICATIONS ABSTRACTED FOR COMMERCIAL FISHERIES ABSTRACTS

DOMESTIC PUBLICATIONS

Analytical Chemistry
American Chemical Society
20th & Northampton Streets
Easton, Pennsylvania

Archives of Biochemistry & Biophysics
Academic Press, Inc.
Prince & Lemon Streets
Lancaster, Pennsylvania

ASHRAE Journal
American Society of Refrigerating and Air-Conditioning Engineers, Inc.
234 Fifth Avenue
New York 1, New York

California Fish and Game
Editor
Department of Fish and Game
722 Capitol Avenue
Sacramento 14, California

Chemical Abstracts
American Chemical Society
20th & Northampton Streets
Easton, Pennsylvania

Chemical and Engineering News
American Chemical Society
20th & Northampton Streets
Easton, Pennsylvania

Chemical Engineering
McGraw-Hill Publishing Co.
330 W. 42nd Street
New York, New York

Chemical Processing
Putman Publishing Co.
111 East Delaware Place
Chicago 11, Illinois

Commercial Fisheries Review
Director, Bureau of Commercial Fisheries
Division of Industrial Research and Services
Fish and Wildlife Service
Department of the Interior
Washington 25, D. C.

Drug and Cosmetic Industry
Drug Markets, Inc.
101 W. 31st Street
New York, New York

Federation Proceedings
Federation of American Societies for Experimental Biology
9650 Wisconsin Street
Washington 14, D. C.

Feed Bag, The
Editorial Service Company
1712 West St. Paul Avenue
Milwaukee 3, Wisconsin

Feedstuffs
Miller Publishing Co.
118 South 6th Street
Minneapolis 2, Minnesota

Fish Boat, The
H. L. Peace Publications
624 Gravier Street
New Orleans 12, Louisiana

Fishing Gazette
Fishing Gazette Publishing Corp.
461 Eighth Avenue
New York, New York

Food Engineering
McGraw-Hill Publishing Co., Inc.
330 W. 42nd Street
New York 18, New York

Food Processing
Putman Publishing Co.
111 East Delaware Place
Chicago 11, Illinois

Food Research
The Garrard Press
510 North Hickory Street
Champaign, Illinois

Food Technology
Institute of Food Technologists
11606 South Bell Avenue
Chicago 43, Illinois

Frosted Food Field
Frosted Food Field, Inc.
19 W. 44th Street
New York 18, New York

Industrial and Engineering Chemistry
American Chemical Society
1155 - 16th Street, N.W.
Washington 6, D. C.

Industrial Refrigeration
Nickerson & Collins Co.
433-435 N. Waller Avenue
Chicago, Illinois

Journal of Agricultural and Food Chemistry
American Chemical Society
20th & Northampton Streets
Easton, Pennsylvania

Journal of the American Chemical Society
American Chemical Society
1155 - 16th Street, N.W.
Washington 6, D. C.

Journal of the American Dietetic Association
American Dietetic Association
620 North Michigan Avenue
Chicago 11, Illinois

Journal of the American Oil Chemists' Society
The American Oil Chemists' Society
35 E. Wacker Drive
Chicago 1, Illinois

Journal of the Association of Official Agricultural Chemists
Association of Official Agricultural Chemists
P. O. Box 540
Benjamin Franklin Station
Washington, D. C.

Journal of Biological Chemistry
The American Society of Biological Chemists, Inc.
Mt. Royal & Guilford Avenues
Baltimore, Maryland

Journal of Nutrition
The Wistar Institute of Anatomy & Biology
36th St. at Spruce
Philadelphia 4, Pennsylvania

Journal of Organic Chemistry
American Chemical Society
20th & Northampton Streets
Easton, Pennsylvania

Maine Coast Fisherman
Maine Coast Fisherman, Inc.
Belfast, Maine

Modern Packaging
Modern Packaging Corporation
575 Madison Avenue
New York 22, New York

National Fisherman
Atlantic Fisherman, Inc.
Goffstown, New Hampshire

National Provisioner
National Provisioner, Inc.
15 W. Huron Street
Chicago 10, Illinois

Nutrition Reviews
Nutrition Foundation, Inc.
99 Park Avenue
New York 16, New York

Pacific Fisherman
Miller Freeman Publishing, Inc.
500 Howard Street
San Francisco 5, California

Poultry Science
Poultry Science Association
Kansas State College
Manhattan, Kansas

Progressive Fish-Culturist
U. S. Department of the Interior
Bureau of Sport Fisheries and Wildlife
Fish and Wildlife Service
Washington 25, D. C.

Quick Frozen Foods
E. W. Williams Publishing, Inc.
82 Wall Street
New York 5, New York

Science
American Association for the Advancement of Science at the Business Press
1515 Massachusetts Avenue, N.W.
Washington 5, D. C.

Seafood Merchandising
H. L. Peace Publications
624 Gravier Street
New Orleans 9, Louisiana

Western Canner/Packer
The Canner Publishing Co.
817 West Market Street
Louisville, Kentucky

Western Feed & Seed
Western States Publications
320 Market Street
San Francisco 11, California

FOREIGN PUBLICATIONS

Analyst, The
14 Belgrave Square
London, S.W., 1, England

Annual Report of the Fisheries Research Board of Canada
Fisheries Research Board of Canada
Ottawa, Ontario, Canada

Biochemical Journal, The
Cambridge University Press
Bentley House
200 Euston Road
London, N.W., 1, England

Biochemistry
(Publication of the Academy of Science of the USSR)
Consultants Bureau, Inc.
227 W. 17th Street
New York 11, New York

Bulletin of the Japanese Society of Scientific Fisheries
Japanese Society of Scientific Fisheries
c/o Tokyo Suisan Daigaku
Shiba-kaigandori 6-Chome
Tokyo, Japan

Bulletin of the Faculty of Fisheries, Hokkaido University
Faculty of Fisheries
Hokkaido University
Hakadote, Japan

Canadian Fisherman
National Business Publications, Ltd.
Gardenvale, Quebec, Canada

Canadian Journal of Biochemistry & Physiology
Division of Administration and Awards
National Research Council
Ottawa 2, Ontario, Canada

Canadian Journal of Chemical Engineering
The Chemical Institute of Canada
18 Rideau Street
Ottawa 2, Ontario, Canada

Canadian Journal of Chemistry
Division of Administration and Awards
National Research Council
Ottawa 2, Ontario, Canada

Chemistry & Industry
14 Belgrave Square
London, W., 1, England

Fette-Seifen-Anstrichmittel
Industrieverlag von Hernhaussen KG
Hamburg 11, West Germany

Fisheries Newsletter
Commonwealth Director of Fisheries, Department of Primary Industry
Canberra, Australia

Food Manufacture
Leonard Hill, Ltd.
Eden Street
London, N.W., 1, England

Food Preservation Quarterly
Division of Food Preservation and Transport
Commonwealth Scientific and Industrial Research Organization
Sydney, Australia

Journal of Applied Chemistry
The Society of Chemical Industry
14 Belgrave Square
London, S.W., 1, England

Journal of the Fisheries Research Board of Canada
University of Toronto Press
Ottawa, Ontario, Canada

Journal of the Science of Food and Agriculture
The Society of Chemical Industry
14 Belgrave Square
London, S.W., 1, England

Modern Refrigeration
Maclaren House
131 Great Suffolk Street
London, S.E., 1, England

Nature
MacMillan & Co., Ltd.
St. Martin's Street
London, W.C., 2, England

Norwegian Fishing News
Kaigaten 8
P. O. Box 222
Bergen, Norway

Progress Reports of Atlantic Coast Stations
Fisheries Research Board of Can.
St. Andrews, New Brunswick, Can.

Progress Reports of Pacific Coast Stations
Technological Station
898 Richards Street
Vancouver 2, B.C., Canada

Report of the Food Investigation Board (Great Britain)
Department of Scientific and Industrial Research
Charles House
5-11 Regent Street
London, S.W., 1, England

Trade News
Director of Information and Educational Service
Department of Fisheries
Ottawa, Ontario, Canada

Western Fisheries
Roy Wrigley Publications, Ltd.
1104 Hornby Street
Vancouver 1, B. C., Canada

World Fisheries Abstracts
FAO Fisheries Division
Technology Branch
Viale delle Terme di Caracalla
Rome, Italy

World Fishing
John Trundell, Ltd.
St. Richards House
Eversholt Street
London, N.W., 1, England

3.64 (Cross Reference: 0.33)

ON THE BROWNING OF DRIED FISH PRODUCTS

Koizumu, Chiaki; Kurobe, Soichi; and Nonaka, Junsaku
Bulletin of the Japanese Society of Scientific Fisheries 25, 368-372 (September 1959) (English abstract, table, and figures)

Aldehydes, ribose, and flat-fish muscle protein that had been freed from reducing sugars and nitrogenous extractives were used in studies in the browning of fish meat. The authors confirmed that crotonaldehyde and acetaldehyde, which are constituents of an autoxidized fish oil, enhance browning, whereas ribose does not enhance browning under the same experimental conditions.

3.64 MOISTURE TRANSFER IN COMBINATION OF DEHYDRATED FOODS

Salwin, Harold and Slawson, Vida (Quartermaster Food and Container Institute for the Armed Forces, Chicago, Illinois)
Food Technology 13, 715-718 (December 1959)

Isotherms which show the relationships between moisture content and vapor pressure (or relative humidity) of the components of a food mixture provide guidance as to their packaging compatibility. A formula is presented for computing from the isotherms the equilibrium relative humidity of such mixtures and the final equilibrium moisture content of each component.

4.60 ANTIOXIDANTS FOR VITAMIN A. PARTS XIV., XV., XVI., XVII., XVIII., XIX., XX.

Katsui, Goichiro; Kuyama, Hiroshi; Kato, Kaoru; Sakamoto, Bunichi; and Ijima, Michiko (Kyoto Univ.)
Chemical Abstracts 51, 15887 (October 25, 1957)

4.60 THE APPLICATION OF ANTIOXIDANTS TO FISH OILS TO INCREASE THEIR STABILITY

Davydova, Yu S. and Treshcheva, V. I.
Chemical Abstracts 53, 7630c (April 25, 1959)

4.60 ESTIMATION OF ANTIOXIDANTS ADDED TO THE MARINE PRODUCTS I. EXTRACTION AND COLORIMETRIC ESTIMATION OF BHA

Toyama, Kenzo; Nakai, Michio, Yamaga, Hiroshi
Bulletin of the Japanese Society of Scientific Fisheries 25, 212-217 (July 1959) (English abstract and tables)

Only the 2,2'-dipyridyl colorimetric method was suitable for determing butylated hydroxyanisole added to marine products.

6.237 STUDIES ON THE ECONOMICAL MANUFACTURE OF VITAMIN A CONCENTRATE FROM FISH LIVER OIL X. ADSORPTION BY WEAKENED ACID CLAY

Higashi, Hideo; Kaneko, Tokugoro; Sugii, Kisaburo; Yamakawa, Takeshige; and Iseki, Shigeo
Bulletin of the Japanese Society of Scientific Fisheries 25, 196-203 (July 1959) (English abstract, figure, and tables)

Acid clay weakened with a definite amount of a water solution of ammonia, urea, or NaOH was used as a material to adsorb impurities from the sample by normal column chromatography, shaking, and stirring. Under certain conditions, it was possible to concentrate vitamin A by the use of weakened acid clay, but constant activity could not be secured with these adsorbents.

6.237 NATURAL VITAMIN A CONCENTRATE I. THE CONCENTRATION OF FISH LIVER OILS BY SAPONIFICATION

Suga, Kyoichi and Watanabe, Shoji
Chemical Abstracts 54, 5017a (March 10, 1960)

6.30 HISTORY OF KELP HARVESTING IN CALIFORNIA

Scofield, W. L. (Long Beach, California)
California Fish and Game 45, 135-137 (July 1959)

6.30 POTENTIAL PRODUCTIVITY OF THE SEA

Ryther, John H. (Woods Hole Oceanographic Institution, Woods Hole, Massachusetts)
Science 130, 602-608 (September 11, 1959)

Organic production by marine plankton algae is comparable to agricultural yields on land.

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7.591 STUDIES ON THE SUCCINIC DEHYDROGENASE OF FISH II. CONDITIONS FOR THE DETERMINATION OF SUCCINIC DEHYDROGENASE ACTIVITY IN HOMOGENATE OF FISH TISSUES

Fukuda, Hironari
Bulletin of the Japanese Society of Scientific Fisheries 23, No. 9, 551-554 (1958) (English abstract and figures)

The optimum concentration of the substrate was 2 ml. of 0.1 M succinate in 10 ml. of the reaction mixture. The optimum concentration of KCN for the inhibition of the cytochrome system was namely, 0.3 ml. of 0.1 M KCN per 10 ml. of the reaction mixture. The optimum pH was 6.7 ±0.1 for various tissues of several kinds of fish. The activity of the enzyme increased with a rise in reaction temperature up to 50°~55° C.

7.591 STUDIES ON THE 5'-ADENYLATE DEAMINASE OF CARP MUSCLE I. ON THE DETERMINATION OF 5'-ADENYLATE DEAMINASE ACTIVITY

Nara, Sakari and Saito, Tsuneyuki
Bulletin of the Faculty of Fisheries, Hokkaido University 10, No. 1, 68-71 (May 1959) (Hakodate, Japan) (English abstract, figures, and table)

The method presented by G. Schmidt (1928) was modified for the determination of 5'-adenylate deaminase. This method was characterized by determining NH_3-nitrogen liberated in low concentration of substrate (2.88×10^{-3} M muscle adenylic acid) and a reaction interval of 10 minutes. NH_3- and protein-nitrogen were measured colorimetrically, and the specific activity was expressed as NH_3-nitrogen (γ) per protein-nitrogen (mg.). About 10 units of specific activity by the modified method correspond to one unit obtained by H. M. Kalckar (1947).

7.872 POLARGRAPHIC STUDIES ON RANCID FISH OIL

Kikuchi, Takeshi and Okada, Ikunosuke (Tokyo Inst. Fisheries)
Chemical Abstracts 52, 7562 (May 10, 1958)

7.872 DETERMINATION OF THE PEROXIDE VALUE OF EDIBLE FATS BY COLORIMETRIC IODOMETRIC PROCEDURES

Swoboda, P. A. T. and Lea, C. H. (Univ. Cambridge, Engl.)
Chemical Abstracts 53, 4600h (March 10, 1959)

7.872 DETERMINATION OF RANCIDITY OF LINSEED OIL BY SPECTROPHOTOMETRIC METHOD

Machulis, P.
Chemical Abstracts 53, 13627f (July 25, 1959)

8.53 BIOCHEMICAL STUDIES ON THE FAT OF THE SARDINE BODY I. SEASONAL VARIATION IN THE FAT, UNSAPONIFIABLE MATTER, AND CHOLESTEROL CONTENTS OF SEVERAL TISSUES OF THE SARDINE BODY

Wada, Masahuto (Nagasaki Univ.)
Chemical Abstracts 52, 20699 (November 25, 1958)

8.53 MARINE EDIBLE FISHES I. DISTRIBUTION OF OIL AND VITAMIN A IN THE SKIN, FLESH, AND LIVER OF EDIBLE FISHES OF KARACHI WATERS

Khan, A. Hameed and Haq, S. Abdul (Pakistan Council Sci. and Ind. Research, Karachi)
Chemical Abstracts 53, 16408b (September 10, 1959)

8.53 FATTY OILS OF AQUATIC INVERTEBRATES XIX. NONCONJUGATED STEROLS AND OTHER UNSAPONIFIABLE COMPONENTS IN THE FATTY OIL FROM TONNA LUTEOSTOMA

Tanaka, Tatsuo and Toyama, Yoshiyuki
Chemical Abstracts 53, 18515a (October 10, 1959)

8.59 BIOCHEMICAL STUDIES ON THE VITAMIN A IN FISH VISCERA IV. LIPOXIDASE IN LIVER AND DARK MUSCLE

Ono, Toyoki; Nagayama, Fumio; and Sasaki, Tadanao
Chemical Abstracts 52, 18920 (November 10, 1958)

8.59 GLUTATHIONE IN MARINE PRODUCTS II. POLAROGRAPHIC DETERMINATION OF GLUTATHIONE IN CARP AND WHALE

Okada, Ikunosuke; Osakabe, Isami; Kuratomi, Yuji; and Sekine, Eiji
Chemical Abstracts 52, 20705 (November 25, 1958)

8.59 FLUORODERMIN, A NEW FLUORESCENT HYDROCARBON IN THE SKIN OF FISH

Hirao, Shuichi and Kikuchi, Ryo
Bulletin of the Japanese Society of Scientific Fisheries 24, No. 9, 781-784 (1959) (No English abstract)

INT.DUP.,D.C.60- 74967

United States
Department of the Interior
Fish and Wildlife Service
Bureau of Commercial Fisheries
Washington 25, D. C.

Official Business